DOCUMENT RESUME

ED 216 140 CE 032 093

AUTHOR Connor, Charles C., Jr.; And Others
TITLE Welding. Post Secondary Curriculum Guide.
INSTITUTION Georgia Univ., Athens. Div. of Vocational Education.
SPONS AGENCY Georgia State Dept. of Education, Atlanta. Office of Vocational Education.
PUB DATE 81
NOTE 292p.

EDRS PRICE MF01/PC12 Plus Postage.
DESCRIPTORS Behavioral Objectives; Disabilities; Educational Resources; Employment Potential; Experiential Learning; Facility Guidelines; Job Skills; *Learning Activities; Mainstreaming; Occupational Information; Postsecondary Education; Special Education; State Curriculum Guides; *Trade and Industrial Education; Vocational Education; *Welding
IDENTIFIERS Georgia

ABSTRACT

This curriculum guide was designed for use in postsecondary welding education programs in Georgia. Its purpose is to provide for the development of entry level skills in welding in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills, and occupational survival skills. The first two sections of 10 explain the philosophy and objectives of state and local vocational education, and of the guide. In section 3, the occupational field of welding is described; and employability skills, student exit points, and tasks cross referenced to the Dictionary of Occupational Titles are listed. The curriculum structure and course outline are provided in section 4, while section 5, the main part of the guide, provides unit guides for each task to be taught. (For each task, a task description, student performance objective, suggested instructional activities, instructional materials, evaluation sections, suggested classroom hours, and related instruction tasks are included.) Section 6 contains references and resources, while student record forms comprise section 7. Following suggestions for working with special needs students (section 8), the guide concludes with a facility layout for a learning resource center and a laboratory, and definitions of terms (sections 9 and 10). (KC)

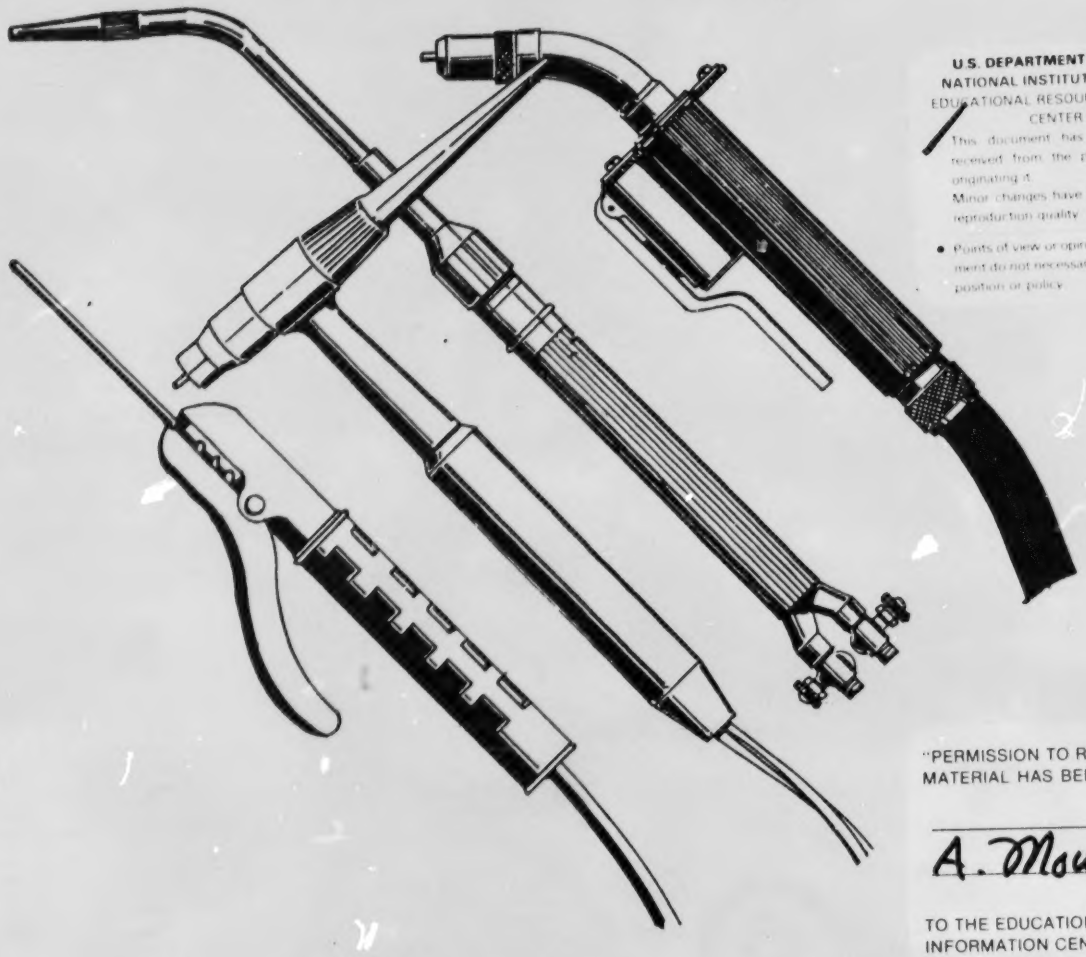
****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

8-013319

WELDING

Post Secondary

ED216140



U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

A. Moughon

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

CE 034 093

CURRICULUM GUIDE

Georgia Department of Education

WELDING

Developed Under Contractual Agreement with

Division of Program Development
Office of Vocational Education
Georgia Department of Education
Atlanta, Georgia 30334
Charles McDaniel, State Superintendent of Schools
1981

WELDING

Developed By

The University of Georgia

Under the Direction of

Dr. Paul Scott

Vocational Education Materials Center

Division of Vocational Education

College of Education

Dr. George L. O'Kelley, Jr.

Division Chairman

DO NOT REMOVE THIS PAGE

WELDING

Charles C. Connor, Jr., Welding Series Editor

DEVELOPERS

Charles C. Connor, Jr.....Principal Developer/Writer

Beverly H. Connor.....Technical Writer

Charles C. Connor, Jr.....Project I Coordinator

CONTRIBUTORS

C. Paul Scott.....Writer, Special Needs

Raymond H. Butler.....Writer, Special Needs

Rhonda Hefner Packer.....Editor/Writer

GRAPHICS

Deborah Moates.....Graphic Technician

TYPISTS

Teresa Whitehead.....Project Secretary

Elisa Cone.....Typist

Sylvia Dorsey.....Typist

Gerry DeWald.....Typist

Carolyn Graham.....Typist

Helen Plymale.....Typist

Gay Weaver.....Typist

Wanda Wright.....Typist

REVIEW PANEL

Clyde Crosby.....Columbus Area Voc-Tech
C. L. Huleman.....South Georgia Tech
John H. Miller.....Griffin-Spalding Co. Area Voc-Tech
Jack L. Northrop, Sr.....DeKalb Area Voc-Tech
Coy Tyler.....Thomas Area Voc-Tech

DO NOT FILM THIS PAGE

Division of Vocational Education
College of Education
University of Georgia, Athens, Ga.

POLICIES AND PROCEDURES FOR THE CENTER

PURPOSE OF THE CENTER

The Vocational Education Materials Center functions within the Division of Vocational Education, University of Georgia. This Center operates under grants from the U.S. Office of Education, and the Georgia State Department of Education with the support of the College of Education. The Center is comprehensive in its commitment and approach to the development and dissemination of materials in the broad field of Vocational Education.

The purpose of the Center is to increase the capability of Georgia's delivery system for Vocational Education. Specifically, the Center is committed to:

1. Develop materials to assist in the implementation of proposed curricula and to enhance the teaching of Vocational Education.

2. Conduct and report curriculum research related to Vocational Education.

3. Provide a production and dissemination center for Vocational Education materials.

4. Provide direct experiences in curriculum development and diffusion for advanced graduate students.

5. Enable faculty members to participate in the development and implementation of a variety of curriculum materials.

Dr. G. L. O'Kelley, Jr.; Chairman
Division of Vocational Education
628 Aderhold Hall
University of Georgia
Athens, Georgia 30602

TABLE OF CONTENTS

SECTION I: PHILOSOPHY AND GOALS (Pink).....I-1

State.....I-3

Local.....I-5

SECTION II: PURPOSE AND OBJECTIVE (Blue).....II-1

Purpose of Guide.....II-3

Program Objective.....II-5

SECTION III: D.O.T. DESCRIPTION, EXIT POINTS, TASK (Green).....III-1

Description of Occupational Field.....III-3

Employability Skills.....III-15

Student Exit Points.....III-16

Task Listing/D.O.T. Code Cross Reference.....III-18

SECTION IV: CURRICULUM STRUCTURE AND COURSE OUTLINE (Yellow).....IV-1

Curriculum Structure.....IV-3

Course Outline.....IV-7

SECTION V: UNIT GUIDES (Gold).....V-1

SECTION VI: REFERENCES, RESOURCES (Pink).....VI-1

Instructional Resource Matrix.....VI-3

Additional Instructional Resources.....VI-31

Publishers and Manufacturers.....VI-35

SECTION VII: STUDENT RECORDS (Blue).....VII-1

Individual Progress Reports.....VII-5

Group Progress Reports.....VII-6

Instructions for Competency Checklist and Certificate of Competency.....VII-7

Competency Checklist.....VII-8

Certificate of Competency.....VII-10

SECTION VIII: SPECIAL NEEDS STUDENTS (Green).....VIII-1

Working with the Special Needs Student.....VIII-3

SECTION IX: FACILITY LAYOUT (Yellow).....IX-1

Learning Resource Center.....IX-3

Laboratory.....IX-7

SECTION X: DEFINITION OF TERMS (Gold).....X-1

SECTION I

PHILOSOPHY & GOALS

DO NOT FILM THIS PAGE

VOCATIONAL EDUCATION IN GEORGIA

A. PHILOSOPHY

The Georgia Board of Education perceives vocational education as a vital component in the education of the young and adult citizens of this State. Appropriate programs of vocational education and ancillary services should be made readily available to individuals in middle schools, high schools, postsecondary area vocational-technical schools, vocational divisions of junior colleges, vocational centers, the Quick Start program and other adult programs designed to train or retrain workers for useful and satisfying employment.

Special services and assistance must be provided to those who need it in order to participate or benefit from vocational education. This includes women, minorities, the displaced homemaker and other displaced workers, those with limited English-speaking ability, the disadvantaged and the handicapped.

Since men and women spend the greater part of their lives at some form of work, the State should provide opportunities for all its citizens to develop the knowledge, skills and attitudes necessary for them to secure personally satisfying and socially useful employment.

B. PURPOSE

The purpose of vocational education shall be to improve the economic well-being of Georgia citizens by preparing individuals, through organized learning experiences, to select, obtain and advance in recognized occupations.

POSTSECONDARY VOCATIONAL EDUCATION

A. PURPOSE

The purpose of postsecondary vocational-technical education in Georgia is to improve the economic well-being of adult citizens by providing access to high quality vocational-technical training for skilled and semi-skilled occupations, for improvement of existing skills or for retraining in a new occupation.

B. OBJECTIVES

1. To provide vocational-technical education programs and ancillary services commensurate with the needs and interests of students and available job opportunities.

2. To provide vocational-technical education programs which are current with the state-of-the-art, competency-based, and offer multiple exit points to accomodate the students' occupational objectives.

3. To provide vocational-technical education programs which are articulated with available high school counterparts, to facilitate an easy transition from secondary to postsecondary levels without loss of credit.

4. To provide vocational-technical education programs such that 75% of those individuals who leave or complete a program of occupational preparation will find employment in the field, or a related field, for which trained.

5. To provide those guidance, counseling, financial aid, evaluative, job placement, remedial and other supportive programs and services needed by students to enroll, complete a program and become, or remain, employable in a skilled or semi-skilled occupation.

6. To provide needed assistance to special populations to include women, minorities, limited English-speaking, the displaced homemaker and other displaced workers, the disadvantaged and the handicapped.

7. To provide vocational-technical education programs for full-time and part-time students on campus during the day as well as the evening hours, and to provide appropriate programs for full-time and part-time students off campus in businesses and industries, comprehensive high schools and other locations within the respective schools' service areas.

8. To serve as a center for the delivery of postsecondary and adult vocational-technical education programs and services for the community and assigned service area.

STATEMENT OF LOCAL SYSTEM PHILOSOPHY, PURPOSE AND GOALS FOR VOCATIONAL EDUCATION

SECTION II

PURPOSE & OBJECTIVES

PURPOSE OF GUIDE

The purpose is defined in terms of the functional needs of each of the identified classes of users in the secondary and post secondary systems.

(a) Vocational teachers.

1. Provide a guide for organizing their program of instruction,
2. Assist in establishing program objectives,
3. Serve as a curriculum materials resource guide,
4. Improve communications with employers and advisory committees,
5. Facilitate competency based instruction,
6. Facilitate either group or self-paced instruction,
7. Include content by quarter and semester,
8. Cross-reference with existing state developed instructional materials (PLACE packages and post secondary I.I.).

(b) Vocational supervisors and administrators.

1. Assist in defining the scope and content of their programs,
2. Provide a means to improve curriculum management functions,
3. Serve as a guide for admissions and job placement functions,
4. Improve communications with employers and advisory committees.

(c) Counseling and guidance staff.

1. Provide a data base for counseling and guidance personnel,
2. Identify student exit points (Carrer Options),
3. Serve as guide for admissions and job placement,
4. Correlate with the new State Board of Education graduation requirements,
5. Provide specific content sequencing by quarter and semester for student scheduling,
6. Provide (a) curriculum options for the disadvantaged handicapped student, (b) curriculum modifications for SPECIAL NEEDS students, (c) typical admission requirements for regular and SPECIAL NEEDS students.

(d) Local Curriculum Coordination Committees.

1. Serve as a guide in working out articulation arrangements,
2. Improve definitions of the relationship between secondary clusters and post secondary specialized programs.

This guide will serve as an ideal communication device between school personnel and the craft advisory committee. By personally reviewing the guide with the local craft advisory committee the teacher will be able to maintain the accuracy of the guide in terms of the local job market and will also be able to inform representatives of local industry regarding the content of the program itself.

WELDING PROGRAM OBJECTIVE

Given appropriate instruction, as suggested by this guide, a student completing the program should demonstrate entry level skills in Welding in the areas of knowledge, theoretical structure, tool usage, diagnostic ability, related supportive skills and occupational survival skills.

As the student progresses through the program, sufficient competencies will be acquired to enable the student to enter the occupational field at the following curriculum exit points.

Welder Helper	(D.O.T. Code 819.687-014)
Brazer	(D.O.T. Code 813.684-010)
Oxyacetylene Welder	(D.O.T. Code 811.684-014)
Shielded Metal Arc Welder	(D.O.T. Code 810.384-014)
TIG Welder	(D.O.T. Code 810.384-014)
MIG Welder	(D.O.T. Code 810.384-014)
Combination Welder	(D.O.T. Code 819.384-010)

SECTION III

D. O. T. DESCRIPTION, EXIT POINTS, TASKS

DO NOT FILM THIS PAGE

DESCRIPTION OF OCCUPATIONAL FIELD

The primary purpose of this section is to provide a general orientation to the occupational field. This orientation may be used by counseling and guidance staff in helping students to select subject areas. It may also be used by instructors for new students just entering the program area. The description delimits the scope of the occupational field in terms of the range of activities involved in a series of occupations. It contains information about career potential within the occupational field, including job market conditions and trends.

The description identifies prerequisite skills and knowledge for those students interested in entering the occupational field. In addition, the Description of Occupational Exit Points is provided to aid the instructor in identifying possible jobs for early leavers. A listing of employability skills is also included in this section.

WELDING

Nature of the Work

Welding is the most common way of permanently joining metal parts. Typically heat is applied to the metal pieces to be joined, the parts melt, fuse and then form a permanent bond. Because of its strength, welding is used to construct and repair parts of ships, automobiles, spacecraft, and thousands of other products. It also joins beams and steel reinforcing rods in buildings, bridges, and highways.

There are three common ways to create the heat that is applied to the parts being joined. In electric arc welding, the most frequently used process, heat is created in the arc as electric current flows through the arc between the tip of the welding electrode and the metal. In resistance welding, heat is created in the weld metal by resistance to the flow of current through the metal. In gas welding, the flame from the combustion of burning gases melts the metal. In arc and gas welding filler materials, called welding electrodes or welding rods, are melted and added to the weld puddle to give the joint greater strength. It is the welder's job to control the amount of heat and the size of the melted area and to add the proper amount of filler material so that they form a strong joint.

Since welding processes differ and are used for many purposes, the equipment and skill levels of welders vary. Some jobs require highly skilled manual welders who know how to safely use gas and electric arc welding equipment in all positions and are able to plan their work from drawings or specifications. Other

jobs can be handled by unskilled welding machine operators who simply press a button to start the welding machine. Skilled welders know the characteristics and properties, such as melting points of steel, aluminum, and other commonly used metals. Examples of skilled welders are maintenance welders, pipe welders and welders who construct ships and bridges.

In ship construction, welders join the steel plates, beams and pipes. Some joints to be welded are on the floor, some are on the walls, and some are overhead. Each must be carefully welded to insure that the ship will not break apart in rough seas.

Ship welders generally use manual arc welding equipment, although semiautomatic equipment is used in some places. After welders read instructions to learn which materials and welding method to use, they obtain supplies from the storage area. To form a joint by arc welding, they use an electrode in a holder attached to an electrical cable coming from a welding power supply. Another such cable is attached to the metal being welded. Thus, electricity will flow through the welding electrode, through the arc to the metal being welded, and back to the power supply. The power supply can be adjusted to provide the correct amount of current. When the power is turned on, welders "strike an arc" by briefly touching the electrode to the metal to start the electricity flowing and then pulling the rod back to form a small arc gap over which the current must flow. If the distance between the electrode and the metal is correct, a stable electric arc will bridge the space; the heat from the arc melts the elect-

rode and the metal. Welders move the arc along the length of the joint. As the electrode melts and becomes shorter, they move the holder closer to the metal to keep the right distance from the arc. They replace very short electrodes.

Maintenance welders repair tools, machines, and equipment. Often they bring portable gas torches, hoses, and tanks to the job because electricity may not be available.

When working on a broken pipe, for example, they examine the pipe and prepare the break for repair. Maintenance welders then select a welding filler rod appropriate for the job. Next, they light the torch and adjust regulators on the cylinders of fuel gas, such as acetylene, and oxygen to obtain the right gas mixtures and flame. Then they heat the edges of the break with the torch. As the metal begins to soften, welders melt the end of the filler rod in the hot liquid metal as they carefully move the torch and rod along the break. Welders must keep the torch the correct distance from the metal, apply heat correctly, and repair the break with filler material.

Not all welders have the skills required of shipbuilding or maintenance workers. For example, less skilled workers use semi-automatic arc weld equipment to weld automobile frames. Semi-automatic equipment automatically supplies the proper amount of arc heat and filler material to the joint. For example, assembly lines bring car frames to welders who then position their welding guns near the parts to be welded and operate a switch on the handle which automatically starts the arc. They guide the arc to complete the required joints before the assembly line takes the

frame to another worker. Like other welders, they are responsible for the quality of the joint. However the job usually requires less manipulative skill because all parts are identical and each is welded in the same position.

Large factories, having many identical parts to be welded may reduce production costs by using automatic arc, electron beam, or resistance welding machines. Workers who operate such machines to weld automobile mufflers and washing machines, for example, need little knowledge of welding. These workers, frequently called welding machine operators to distinguish them from more skilled, manual welders, place the parts to be joined in fixtures on the machine and push a button. The machine then clamps the part in place and positions it, as necessary to complete the welding cycle. After the cycle is finished, operators remove the welded parts and load the machine again.

The work of arc and flame cutters is closely related to that of welders. Using heat from burning gases or an electric arc, cutters cut and trim rather than join metal. Some electrically and mechanically operated machines follow guidelines automatically.

Working Conditions

Welders are exposed to more potential hazards than most other workers. They use protective clothing, safety shoes, goggles, helmets with protective lenses, and other devices to prevent burns and eye injuries. Although lighting and ventilation usually are adequate, some metals give off toxic gases and fumes as they melt. Workers often are in contact with rust, grease, and

dirt on metal surfaces. Machine operators, however, are largely free from hazards associated with manual welding. A face shield or goggles generally are adequate protection. Skilled welders, working in welding booths, often have long periods of isolation from other workers.

Places of Employment

Almost two-thirds of all welders help manufacture durable goods; for example, boilers, bulldozers, trucks, ships, and heavy machinery. Most of the rest repair metal products or help construct bridges, large buildings, and pipelines.

Welders are concentrated in the manufacturing centers of the Great Lakes states. About one-third work in Pennsylvania, Ohio, Michigan, Indiana, and Illinois. The rest are distributed much the same as the population, with large numbers in New York, Texas, Wisconsin, and California.

Training, Other Qualifications, and Advancement

Though several years of on-the-job training are required to become a skilled welder, less skilled work can be learned on the job in a few months. Some welding operators, for example, can operate a machine in a few hours and handle all parts of their job in a week.

Beginners often start in simple production jobs where the type and thickness of the metal and the position of the welding operation rarely change. As the need arises, supervisors or experienced workers teach new employees how to weld vertical and overhead joints and different metals. Many large companies train their own welders. A few companies have apprenticeship

programs including classroom and on-the-job training that last several years.

Persons planning careers as welders or cutters need manual dexterity, good eyesight, and good eye-hand coordination. They should have the ability to concentrate on detailed work for long periods, and be physically able to bend, stoop, and work in awkward positions. Most employers prefer applicants who have high school or vocational school training in welding. Courses in shop mathematics, mechanical drawing, blueprint reading, physics, and chemistry also are helpful.

New technological developments, especially in nuclear energy and aerospace, require new skills. Because of the hazards of nuclear power plant operation or high-speed air and space travel, both industries demand high standards of reliability for welds. Before being assigned to work on buildings, bridges, pipelines, or other jobs where the strength of the weld is highly critical, welders may be required to pass an examination of their welding skills given by an employer or government agency. Welders who pass such examinations generally are referred to as "certified welders."

Promotion opportunities for welders are good. Some welding machine operators learn skilled welding jobs; skilled welders may be promoted to welding inspectors, technicians, or supervisors. Experienced workers who have obtained college training are in great demand as welding engineers to develop new applications for welding. A small number of experienced welders open their own repair shops.

Employment Outlook

Employment for welders is expected to increase faster than the average for all occupations through the 1980's because of the greater use of welding. In addition, many jobs should arise each year as welders retire, die, or transfer to other occupations. Job opportunities may vary as the economy fluctuates.

Increases in population and income are expected to stimulate demand for cars, buildings, heavy machinery, appliances, and thousands of other products that welders help make. Employment of welders also is expected to increase as welding replaces other methods of joining metals. Welding generally is cheaper than other methods of joining metal parts, and it is being used more frequently in the manufacturing and construction industries.

Professional Unions

Welders belong to many different unions. Among these are the International Association of Machinists and Aeorspace Workers; the International Brotherhood of Boilermakers, Iron shipbuilders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aerospace and Agricultural Implement Workers of America; the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; and the United Electrical, Radio and Machine Workers of America (Ind.).

Related Occupations

Welders are highly skilled workers who must be very familiar with the properties of metal and use hand-held equipment or machines to do factory or construction work. Other people with similar duties are blacksmiths, forge shop workers, all-round

machinists, instrument makers (mechanical), machine tool operators, and tool-and-die makers.

Sources of Additional Information

For further information on training and work opportunities for welders, contact local employers or the local office of the State employment service. For general information about welders, write to: The American Welding Society, 2501 NW 7th Street, Miami, Florida 33125. International Union, United Automobile, Aerospace and Agricultural Implement Workers of America, 8000 East Jefferson Avenue, Detroit, Michigan, 48214.

The information on the occupational field contained in this section of the Curriculum Guide was reprinted from the Occupational Outlook Handbook, 1980-1981 Edition. Additional reprints can be purchased as Bulleton No. 2075-2 "Metalworking Occupations," from BLS Regional Office, 1371 Peachtree Street, N.E., Atlanta, Georgia 30309.

819.687-014 Welder Helper

Performs any combination of following duties to assist workers in welding, brazing, and thermal and arc cutting activities: Moves work-pieces, tools, and supplies, manually or by handtruck. Lifts, moves and holds, or clamps workpieces to table, into jigs, or into position as directed, manually or by using joist, pry bars, wrenches, hammer, and wedges. Cleans workpieces to remove impurities, such as slag, rust, and grease, using wire brush, portable grinder, hand scraper, or chemical solutions. Connects hoses from hand torch to oxygen and fuel gas cylinders or connects cables from power source to electrode holder and workpiece or fixture. Starts gasoline engine to activate electric generators. Places workpieces into furnace to preheat for specified time. Removes, tags or marks, and moves finished work. May attach grappling equipment to objects preparatory to movement by crane. May be designated according to type of activity as THERMAL-CUTTER HELPER (welding).

813.684-010 Brazer

Brazes (bonds) together components to assemble metal parts as specified by layout, work order, or blueprints, using hand torch: Alines and clamps workpieces together, using rule, square, or template or sets up and places them in fixtures, jigs, or vise. Cleans joints of workpieces using wire brush or by dipping them into cleaning solution. Selects torch tip, flux, and brazing alloy from data charts or work order. Connects hoses from torch to regulator valves and cylinders of oxygen and specified fuel gas, acetylene or natural. Turns valves to start flow of gases, lights flame, and adjusts pressure and mixture of gases to obtain desired color and size of flame. Brushes flux onto joint of workpiece or dips braze rod into flux to prevent oxidation of metal. Guides torch and rod along joint or seam of workpiece to heat to brazing temperature and melt braze alloy to bond workpieces together. Examines seam and rebrazes defective joints. May braze together broken parts and cover holes to repair leaks. May specialize in bonding parts with soft solder and be designated SOLDERER, TORCH (welding) II. May melt and separate brazed joints, using hand torch or furnace, remove and straighten components, and rebraze joints to repair misalined or damaged assemblies and be designated BRAZER, REPAIR AND SALVAGE (welding). May braze together seams of metal sheets, strips, screening, or wire cloth, using torch mounted on manually guided crawler, and be designated BRAZER, CRAWLER TORCH (welding).

811.684-014 Oxyacetylene Welder

Welds metal parts, using gas welding equipment as specified by layout, welding diagram, or work order: Positions parts in jigs or fixtures on bench or floor, or clamps parts together along layout marks. Selects torch, torch tip, filler rod and flux, according to welding chart specifications or type and thickness of metal. Connects regulator valves and hoses to oxygen and fuel gas cylinders, and welding torch. Turns regulator valves to activate flow of gases, lights torch and adjusts gas mixture and pressure, to obtain desired flame, based on knowledge of gas-welding techniques. Holds torch at proper angle to metal and guides along weld joint, applying filler rod to molten area to form weld. Examines weld for bead size and other specifications. Repairs broken or cracked metal objects, fills holes, and builds up metal parts. May apply flux to workpiece instead of filler rod. May preheat workpiece in furnace or with torch. May layout, position and tack weld workpieces. May weld along vertical or overhead weld lines. May scarf or groove weld prior to applying filler metal, using gas welding equipment. May chip or grind off excess weld, slag, or spatter (GRINDER-CHIPPER any ind. II). May clean or degrease parts, using wire brush, portable grinder, or chemical bath. May cut metal plates or structural shapes using gas torch. May be designated according to type of gases used such as WELDER, ACETYLENE (welding); WELDER, OXYACETYLENE (welding); WELDER, OXYHYDROGEN (welding). Important variations include type of metals welded, products, subprocesses, trade name of equipment, worksite (in-plant, job shop, construction site, shipyard), high-production or custom, level of ambidexterity required or type of joints welded (seam, spot, butt). May be required to pass employer performance tests or standard tests to meet certification standards of governmental agencies or professional and technical associations.

810.384-014 Arc Welder

Shielded Metal Arc Welder
Tungsten Inert Gas Welder
Metal Inert Gas Welder

Welds together metal components of such products as pipelines, automobiles, boilers, ships, aircraft, and mobile homes, as specified by layout, blueprints, diagram, work order, welding procedures, or oral instructions, using electric arc-welding equipment: Obtains specified electrode and inserts into portable holder or threads consumable electrode wire through portable welding gun. Connects cables from welding unit to obtain amperage, voltage, slope, and pulse, as specified by WELDING ENGINEER (profess. & kin.) or WELDING TECHNICIAN (profess. & kin.). Starts power supply to produce electric current. Strikes (forms) arc which generates heat to melt and deposit metal from electrode to workpiece and join edges of workpiece. Manually guides electrode or gun along weld line, maintaining length of arc and speed of movement to form specified depth of

fusion and bead, as judged from color of metal, sound of weld, and size of molten puddle. Welds in flat, horizontal, vertical, or overhead positions. Examines weld for bead size and other specifications. May manually apply filler rod to supply weld metal. May clean or degrease weld joint or workpiece, using wire brush, portable grinder, or chemical bath. May repair broken or cracked parts and fill holes. May prepare broken parts for welding by grooving or scarfing surfaces. May chip off excess weld, slag, spatter, using hand scraper or power chipper. May preheat workpiece, using hand torch or heating furnace. May position and clamp workpieces together or assemble them in jig or fixture. May tack assemblies together. May cut metal plates or structural shapes (ARC CUTTER welding). May be designated according to type of equipment used as WELDER, CARBON ARC welding; WELDER, FLUX-CORED ARC welding; WELDER, GAS-METAL ARC welding; WELDER, GAS-TUNGSTEN ARC welding; WELDER, HAND, SUBMERGED ARC welding; WELDER, PLASMA ARC welding; WELDER, SHIELDED-METAL ARC welding. May be designated according to product welded as WELDER, BOILERMAKER boilermaking. Important variations include types of metals welded, subprocesses used, trade name of equipment used, worksite (inplant, job shop, construction site, shipyard), method of application (manual, semiautomatic), high-production or custom, level of ambidexterity required, type of joints welded (seam, spot, butt). May be required to pass employer performance tests or standard tests to meet certification standards of governmental agencies or professional and technical associations.

819.384-010 Combination Welder

Welds metal components together to fabricate or repair products, such as machine parts, plant equipment, mobile homes, motors, and generators, according to layouts, blueprints, or work orders, using brazing and variety of arc and gas welding equipment: Welds metal parts together, using both gas welding (WELDER, GAS welding) or brazing (BRAZER, ASSEMBLER welding) and any combination of arc welding processes (WELDER, ARC welding). Performs related tasks, such as thermal cutting and grinding. Repairs broken or cracked parts, fills holes, and increases size of metal parts. Positions and clamps together components of fabricated metal products preparatory to welding. May locate and repair cracks in industrial engine cylinder heads, using inspection equipment and gas torch, and be designated REPAIRER, CYLINDER HEADS welding. May perform repairs only, and be designated WELDER, REPAIR welding. May be required to pass employer performance tests or standard tests to meet certification standards of governmental agencies or professional and technical associations.

EMPLOYABILITY SKILLS

In addition to the aptitudes, abilities, interests, physical requirements and job skills listed in the preceding Description of Occupation, employability skills exert a great deal of influence on a person's ability to get and keep a job. Surveys indicate that more people lose their jobs because of poor attitudes toward their job than for lack of job skills. For this reason it is important that information concerning the following employability skills be provided as an ongoing part of the program.

1. Getting a job
   a. Filling out job applications
   b. Developing a resume
   c. Preparing for a job interview

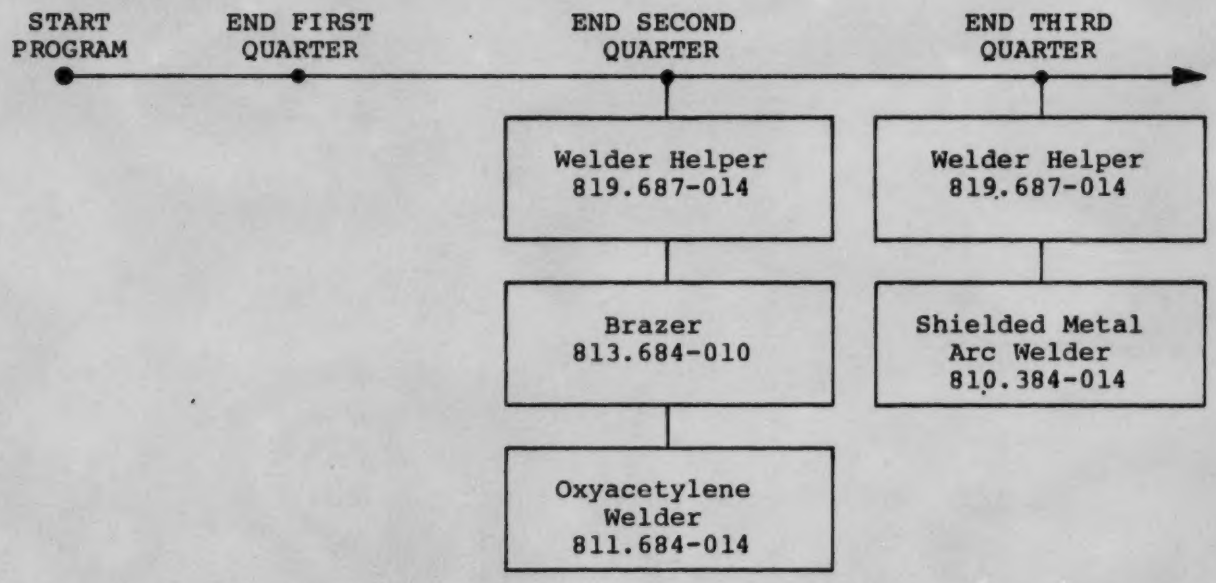
2. Keeping a job
   a. Be on time and regular in attendance
   b. Maintain a fair share of the work-load
   c. Work without supervision
   d. Meet production schedules
   e. Properly care for and use equipment
   f. Dress appropriately for the job
   g. Maintain good personal hygiene
   h. Develop and maintain good communication with supervisors and co-workers

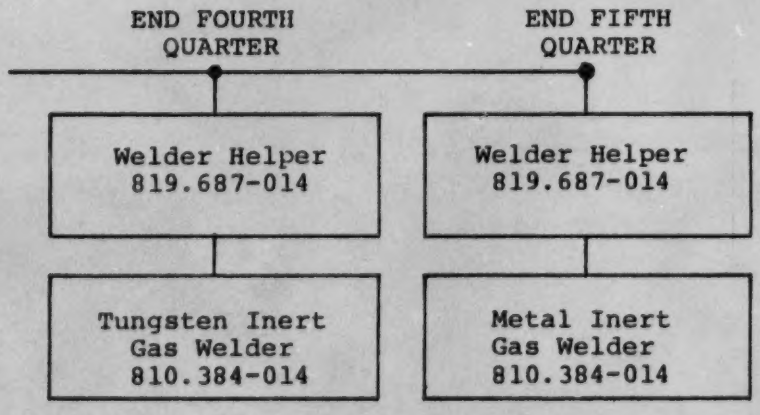
EXIT POINTS BY QUARTER

The diagram on the following page showing the occupational exit points by quarter is based on the suggested Curriculum Structure (Alternative I) and the suggested Course Outline presented in this curriculum guide. It graphically illustrates the points in the Welding program where the student should have acquired the competencies necessary for entry level employment into the job classifications indicated.

This diagram is based on only one sequence of teaching. The exit points may be rearranged by teaching the units in a different order. This flexibility allows the teacher to sequence the courses according to local preference. It also allows the curriculum to be individualized where individualization is preferred.

OCCUPATIONAL EXIT POINTS BY QUARTER
WELDING





TASK LISTING BY D.O.T. CODE

In this section the occupational exit points from the curriculum are cross referenced with the tasks which are required for employment in each job title. On the line following each task an x appears in the column of each job title to which the task applies. All the tasks listed in this matrix are taught in the curriculum presented in this guide. A detailed treatment of each task appears in the Unit Guides section of this curriculum guide.

TASK LISTING BY DOT CODE

WELDING

TASK NO.	TASK NAME	POSSIBLE EXIT POINTS	DOT DESCRIPTIONS	Welder Helper	Brazer	Oxyacetylene Welder	Shielded Metal Arc Welder	TIG Welder	MIG Welder	Combination Welder
			DOT NO.	819.687-014	813.684-010	811.684-014	810.384-014	810.384-014	810.384-014	819.384-010
	FOUNDATIONS									
WLD-1	Orientation to the welding program			X	X	X	X	X	X	X
WLD-2	Identifying and using welding symbols			X	X	X	X	X	X	X
WLD-3	Using welding related shop tools and equipment			X	X	X	X	X	X	X
WLD-4	Identifying and preparing metals for welding			X	X	X	X	X	X	X
WLD-5	Measuring welding materials			X	X	X	X	X	X	X
WLD-6	Using clamps and jigs			X	X	X	X	X	X	X
WLD-7	Reading blueprints			X	X	X	X	X	X	X
	OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING									
OXA-1	Following safety procedures and regulations for oxyacetylene welding			X	X	X				X
OXA-2	Using oxyacetylene cylinders and gases			X	X	X				X
OXA-3	Inspecting oxygen and acetylene regulators									
OXA-4	Selecting and maintaining oxyacetylene torches and tips			X	X	X				X

TASK LISTING BY DOT CODE

WELDING

TASK NO.	TASK NAME	POSSIBLE EXIT POINTS	DOT DESCRIPTIONS	Welder Helper	Brazer	Oxyacetylene Welder	Shielded Metal Arc Welder	TIG Welder	MIG Welder	Combination Welder
			DOT NO.	819.687-014	813.684-010	811.684-014	810.384-014	810.384-014	810.384-014	819.384-010
OXA-5	Setting up and lighting the									
	oxyacetylene torch			X	X	X				X
OXA-6	Carrying a puddle without a filler									
	rod				X	X				X
OXA-7	Welding an outside corner joint with-									
	out a filler rod using oxyacetylene									
	equipment				X	X				X
OXA-8	Making beads with filler rods using									
	oxyacetylene equipment					X				X
OXA-9	Welding butt joints using oxyacetylene									
	equipment					X				X
OXA-10	Welding lap joints using oxyacetylene									
	equipment					X				X
OXA-11	Welding T-joints using oxyacetylene									
	equipment					X				X
OXA-12	Setting up the oxyacetylene apparatus									
	for flame cutting			X		X				X
OXA-13	Cutting with an oxyacetylene cutting									
	torch					X				X
OXA-14	Piercing and cutting holes using the									
	oxyacetylene cutting torch					X				X

TASK LISTING BY DOT CODE

WELDING

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO.	DOT DESCRIPTIONS						
		819.687-014	Welder Helper	813.684-010	Brazer	811.684-014	Oxyacetylene Welder	810.384-014	Shielded Metal Arc Welder	810.384-014	TIG Welder	810.384-014	MIG Welder	819.384-010	Combination Welder
OXA-15	Cutting with an automatic oxyacetylene														
	cutting machine					X								X	
OXA-16	Welding beads with brass rods using														
	oxyacetylene welding equipment			X		X								X	
OXA-17	Brazing a lap joint using oxyacetylene														
	apparatus			X		X								X	
OXA-18	Brazing with silver using oxyacetylene														
	equipment			X		X								X	
OXA-19	Soldering			X		X								X	
OXA-20	Welding cast iron using oxyacetylene														
	apparatus					X								X	
OXA-21	Cutting and welding pipe using														
	oxyacetylene apparatus					X								X	
	SHIELDED ARC WELDING														
ARC-1	Selecting and setting up shielded arc														
	welding apparatus	X						X						X	
ARC-2	Welding string and weave beads using														
	shielded arc welding apparatus							X						X	
ARC-3	Arc welding string beads and padding														
	a plate							X						X	

TASK LISTING BY DOT CODE

WELDING

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO.	Welder Helper 819.687-014	Brazer 813.684-010	Oxyacetylene Welder 811.684-014	Shielded Metal Arc Welder 810.384-014	TIG Welder 810.384-014	MIG Welder 810.384-014	Combination Welder 819.384-010
		DOT DESCRIPTIONS							
ARC-4	Arc Welding lap joints					X			X
ARC-5	Arc welding butt joints					X			X
ARC-6	Shielded arc welding T-fillet joints					X			X
ARC-7	Testing arc welded joints					X			X
	TUNGSTEN INERT GAS WELDING								
TIG-1	Orientation to tungsten inert gas arc								
	welding	X					X		X
TIG-2	Following safety procedures and								
	regulations for TIG welding	X					X		X
TIG-3	Identifying TIG welding equipment	X					X		X
TIG-4	Setting up TIG equipment to weld								
	aluminum	X					X		X
TIG-5	TIG welding stringer beads on aluminum								
	plate						X		X
TIG-6	TIG welding lap joints using aluminum								
	plate						X		X
TIG-7	TIG welding butt joints using aluminum								
	plate						X		X
TIG-8	TIG welding fillet joints using								
	aluminum plate						X		X

TASK LISTING BY DOT CODE

WELDING

TASK NO.	TASK NAME	POSSIBLE EXIT POINTS: DOT NO.	DOT DESCRIPTIONS: Welder Helper (819.687-014)	Brazer (813.684-010)	Oxyacetylene Welder (811.684-014)	Shielded Metal Arc Welder (810.384-014)	TIG Welder (810.384-014)	MIG Welder (810.384-014)	Combination Welder (819.384-010)
TIG-9	TIG welding corner joints using								
	aluminum plate						X		X
TIG-10	Setting up TIG equipment to weld								
	stainless steel and mild steel		X				X		X
TIG-11	TIG welding stringer beads on stain-								
	less steel and mild steel						X		X
TIG-12	TIG welding lap joints using stain-								
	less steel and mild steel plate						X		X
TIG-13	TIG welding butt joints using stain-								
	less steel and mild steel plate						X		X
TIG-14	TIG welding fillet joints using stain-								
	less steel and mild steel plate						X		X
TIG-15	TIG welding corner joints using stain-								
	less steel and mild steel plate						X		X
TIG-16	TIG welding pipe joints						X		X
	METAL INERT GAS WELDING								
MIG-1	MIG orientation and safety		X					X	X
MIG-2	MIG welding beads on mild steel plate		*					X	X
MIG-3	MIG welding butt joints using mild								
	steel plate							X	X

TASK LISTING BY DOT CODE

WELDING

POSSIBLE EXIT POINTS

TASK NO.	TASK NAME	DOT NO.	DOT DESCRIPTIONS: Welder Helper	Brazer	Oxyacetylene Welder	Shielded Metal Arc Welder	TIG Welder	MIG Welder	Combination Welder
		819.687-014		813.684-010	811.684-014	810.384-014	810.384-014	810.384-014	819.384-010
MIG-4	MIG welding lap joints using mild steel plate							X	X
MIG-5	MIG welding fillet joints using mild steel plate							X	X
MIG-6	MIG welding with stainless steel		*					X	X
MIG-7	MIG welding with aluminum		*					X	X
MIG-8	Flux-cored arc welding (FCAW)		*					X	X

* Setting up the equipment for welding

SECTION IV

CURRICULUM STRUCTURE & COURSE OUTLINE

DO NOT FILM THIS PAGE

CURRICULUM STRUCTURE

The following examples of curriculum structures are provided to illustrate the different ways a Welding curriculum may be structured. The examples are not intended to imply there are not other ways to structure the curriculum.

Alternative I is based on the curriculum outline. Both Alternatives I and II are examples of programs within Georgia. The time estimates of each alternative vary according to local program objectives. The actual amount of time required for each course will depend upon the instructor, the students and facilities available.

Each instructor is encouraged to structure the curriculum and make time estimates based on experience, industry requirements, students' needs and the local facilities (classroom, equipment, lab) available.

WELDING CURRICULUM STRUCTURE

Alternative I

Course Number	Course Title	Clock Hours
	First Quarter	
	Basic Math	80
	Foundations for Welding	230
		310
	Second Quarter	
	Oxyacetylene Welding	195
	Oxyacetylene Cutting	60
	Brazing	56
	Soldering	20
		331
	Third Quarter	
	Basic Shielded Arc Welding	108
	Advanced Shielded Arc Welding	200
		308
	Fourth Quarter	
	Basic Tungsten Inert Gas Welding	152
	Advanced Tungsten Inert Gas Welding	168
		320
	Fifth Quarter	
	Basic Metal Inert Gas Welding	124
	Advanced Metal Inert Gas Welding	190
		314

WELDING CURRICULUM STRUCTURE

Alternative II

Course Number	Course Title	Clock Hours
	First Quarter	
	Industrial Safety	52
	Basic Oxyacetylene Cutting	52
	Basic Arc Welding	208
		312
	Second Quarter	
	Basic Blueprint Reading and Sketching	52
	Advanced Arc Welding	208
	Basic Oxyacetylene Welding	52
		312
	Third Quarter	
	Advanced Oxyacetylene Welding	104
	Basic MIG Welding	52
	Advanced MIG Welding	104
	Consumer Education	52
		312
	Fourth Quarter	
	MIG Welding Shop Applications	52
	Basic TIG Welding	52
	Advanced TIG Welding	156
	TIG Welding Shop Applications	52
		312
	Total:	1,248

WELDING CURRICULUM STRUCTURE

Alternative III

Course Number	Course Title	Clock Hours
	First Quarter	
	Basic Math	52
	Shear, Drill and Saw Work	55
	Oxyacetylene Flame Cutting	60
	Welding Symbols	53
	Oxyacetylene Welding	80
		300
	Second Quarter	
	Basic Arc Welding	140
	Metallurgy	30
	Communication Skills	52
	Advanced Arc Welding	78
		300
	Third Quarter	
	Advanced Arc Welding	59
	Human Relations	52
	Fabrication	49
	Tungsten Inert Gas Welding	70
	Metal Inert Gas Welding	70
		300
	Fourth Quarter	
	Blueprint Reading	80
	Fabrication	190
	Flux Cored Arc Welding	30
		300

SUGGESTED COURSE OUTLINE FOR WELDING

The course outline presented in this section represents one suggested order for teaching the tasks that will qualify the student for employment in the occupational job titles that have been specified. This is not the only acceptable order for teaching the tasks. Therefore, the instructor should use whatever degree of latitude is desirable in designing the local curriculum, so long as the prerequisites to some tasks are recognized and so long as specific occupational exit points are the end product.

This flexibility of sequence is an aid in designing separate courses and is also well suited for designing course content for individual students.

SUGGESTED COURSE OUTLINE FOR WELDING

Quarter I

Unit	Title	Clock Hours
	Performance Group: Foundations for Welding	
WLD-1	Orientation to the welding program	7
WLD-2	Identifying and using welding symbols	14
WLD-3	Using welding related shop tools and equipment	80
WLD-4	Identifying and preparing metals for welding	35
WLD-5	Measuring welding materials	7
WLD-6	Using clamps and jigs	7
WLD-7	Reading blueprints	80
	Total Hours:	230

Quarter II

Unit	Title	Clock Hours
	Performance Group: Oxyacetylene Welding, Cutting, Brazing and Soldering	
OXA-1	Following safety procedures and regulations for oxyacetylene welding	4
OXA-2	Using oxyacetylene cylinders and gases	7
OXA-3	Inspecting oxygen and acetylene regulators	7
OXA-4	Selecting and maintaining oxyacetylene torches and tips	4
OXA-5	Setting up and lighting the oxyacetylene torch	4
OXA-6	Carrying a puddle without a filler rod	12
OXA-7	Welding an outside corner joint without a filler rod using oxyacetylene equipment	16
OXA-8	Making beads with filler rods using oxyacetylene equipment	16
OXA-9	Welding butt joints using oxyacetylene equipment	30
OXA-10	Welding lap joints using oxyacetylene equipment	20
OXA-11	Welding T-joints using oxyacetylene equipment	35
OXA-12	Setting up the oxyacetylene apparatus for flame cutting	5
OXA-13	Cutting with an oxyacetylene cutting torch	20
OXA-14	Piercing and cutting holes using the oxyacetylene cutting torch	20
OXA-15	Cutting with an automatic oxyacetylene cutting machine	15
OXA-16	Welding beads with brass rods using oxyacetylene welding equipment	16
OXA-17	Brazing a lap joint using oxyacetylene apparatus	20
OXA-18	Brazing with silver using oxyacetylene equipment	20
OXA-19	Soldering	20
OXA-20	Welding cast iron using oxyacetylene apparatus	10
OXA-21	Cutting and welding pipe using oxyacetylene apparatus	30
	Total Hours:	331

EXIT POINTS: Oxyacetylene Welder (D.O.T. 811.684-014)
Brazer (D.O.T. 813.684-010)

Quarter III

Unit	Title	Clock Hours
	Performance Group: Shielded Metal Arc Welding	
ARC-1	Selecting and setting up shielded arc welding apparatus	20
ARC-2	Welding string and weave beads using shielded arc welding apparatus	63
ARC-3	Arc welding string beads and padding a plate	25
ARC-4	Arc welding lap joints	50
ARC-5	Arc welding butt joints	70
ARC-6	Shielded arc welding T-fillet joints	70
ARC-7	Testing arc welded joints	10
	Total Hours:	308

EXIT POINTS: Shielded Metal Arc Welder
(D.O.T. 810.384-014)

Quarter IV

Unit	Title	Clock Hours
	Performance Group: Tungsten Inert Gas Welding	
TIG-1	Orientation to tungsten inert gas arc welding	7
TIG-2	Following safety procedures and regulations for TIG welding	4
TIG-3	Identifying TIG welding equipment	3
TIG-4	Setting up TIG equipment to weld aluminum	7
TIG-5	TIG welding stringer beads on aluminum plate	20
TIG-6	TIG welding lap joints using aluminum plate	20
TIG-7	TIG welding butt joints using aluminum plate	35
TIG-8	TIG welding fillet joints using aluminum plate	35
TIG-9	TIG welding corner joints using aluminum plate	21
TIG-10	Setting up TIG equipment to weld stainless steel and mild steel	7
TIG-11	TIG welding stringer beads on stainless steel and mild steel	20
TIG-12	TIG welding lap joints using stainless steel and mild steel plate	20
TIG-13	TIG welding butt joints using stainless steel and mild steel plate	35
TIG-14	TIG welding fillet joints using stainless steel and mild steel plate	35
TIG-15	TIG welding corner joints using stainless steel and mild steel plate	21
TIG-16	TIG welding pipe joints	30
	Total Hours:	320

EXIT POINTS: TIG Welder (D.O.T. 810.384-014)

Quarter V

Unit	Title	Clock Hours
	Performance Group: Metal Inert Gas Welding	
MIG-1	MIG orientation and safety	10
MIG-2	MIG welding beads on mild steel plate	24
MIG-3	MIG welding butt joints using mild steel plate	35
MIG-4	MIG welding lap joints using mild steel plate	20
MIG-5	MIG welding fillet joints using mild steel plate	35
MIG-6	MIG welding with stainless steel	80
MIG-7	MIG welding with aluminum	80
MIG-8	Flux-cored arc welding (FCAW)	30
	Total Hours	314

EXIT POINTS: MIG Welder (D.O.T. 810.384-014)
Combination Welder (D.O.T. 819.384-010)
Welder Helper (D.O.T. 819.687-014)

SECTION V

UNIT GUIDES

DO NOT FILM THIS PAGE

UNIT GUIDES

Description

In this section the tasks to be taught in each course are presented in sequential order. Each task is listed on a separate page so that it may be taken out of the guide for daily lesson planning or regrouped with other tasks to fit the individual teacher's own preference for teaching order. The task pages may be used for planning and executing group instruction or for individualized instruction. Each page in the UNIT GUIDES section contains the following information:

TASK: This is a short and concise statement of the task to be taught.

PERFORMANCE OBJECTIVE: The performance expected of the student after completing the unit is stated in stem form, without a specific statement of all conditions, equipment, and performance standard (these are listed in a criterion referenced measure in the Evaluation section of the task page).

INSTRUCTIONAL ACTIVITIES: Suggested learning activities are presented. These activities include providing information, demonstration use of audio visuals, and practical applications.

INSTRUCTIONAL MATERIALS: The materials that are necessary to carry out the instructional activities are listed. These include textbooks, audio visuals and equipment.

EVALUATION: This section contains a criterion referenced measure (where appropriate) and reference to any test items or other evaluation measures that are available to the teacher. The criterion referenced measure contains three parts--Condition, Performance and Standard.

CLASSROOM HOURS: The estimated time for completion of the instructional activities and the evaluation are indicated. This time estimate is stated in hours of classroom time related to each task.

TASK

WLD-1 Becoming acquainted with the welding program

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of shop regulations, safety and the use of instructional materials.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Shop Layout
b. Learning Resource Center
c. Regulations
d. Audio-visual materials
e. Shop safety
f. Welding terminology

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Welding Processes
d. Oregon

Student Manuals:

Georgia, Welding, Phase A, Unit 1

A/Vs:

a. Georgia, Slide/Tape (A-01), "Operating the Singer Caramate"
b. Georgia, Slide/Tape (A-03), "Introduction to Individualized Instruction"
c. Georgia, Slide/Tape (A-04), "General Shop Safety"

CLASSROOM HOURS

7

EVALUATION WLD-1 (continued)

a. Given a list of standard shop materials, equipment and practices, the student will correctly identify safe and unsafe practices and precautionary measures to be taken to prevent hazardous situations.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-1, Georgia Department of Education.

TASK

WLD-2 Identifying and using welding symbols

PERFORMANCE OBJECTIVE

Correctly identify standard welding symbols and interpret shop sketches.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of welding symbols
b. The basic welding symbol
    1. Reference line
    2. Arrow
    3. Tail
    4. Arrow side
    5. Other side
c. Weld symbols for type of joint or weld
    1. Groove (Square, V, Bevel, U, J, Flare-V & Flare-Bevel)
    2. Fillet
    3. Plug or slot
    4. Seam
    5. Back or backing
    6. Surfacing
    7. Flange

(Continued on back)

Provide Demonstration On:

Standard and supplementary symbols and their meanings

Provide Practical Application On:

a. Interpreting symbols from shop sketches and drawings
b. Drawing symbols for various types of welds

INSTRUCTIONAL MATERIALS

Textbooks:

a. Griffin, Welding Processes
b. Schell and Matlock

Tools and Supplies (or equipment):

a. American Welding Society Chart of Standard Welding Symbols
b. Samples of various types of welded joints
c. Shop sketches

CLASSROOM HOURS

14

EVALUATION WLD-2 (continued)

The student will correctly identify symbols that appear on the American Welding Society chart of standard welding symbols and will draw symbols to represent sample welds presented by the instructor.

Provide Information On: (continued)

d. Dimensions
e. Supplementary symbols
    1. Weld-all-around
    2. Field weld
    3. Melt-thru
    4. Contour
    5. Finish
    6. Groove, angle
    7. Abbreviations
    8. Size: size or strength
    9. Effective throat
    10. Root opening
    11. Length of weld
    12. Pitch
    13. Number of spot or projection welds

TASK

WLD-3 Using welding related shop tools

PERFORMANCE OBJECTIVE

Demonstrate the proper and safe use and care of welding related hand and powered tools and equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Proper care and use of common hand tools
   1. Hammers
   2. Hand saws
   3. Chisels and punches
   4. Brushes
   5. Files
   6. Marking tools
   7. Rules, straight edges, squares, dividers, etc.
b. Proper care and use of common powered tools and equipment
   1. Chipping hammer
   2. Drills
   3. Grinders
   4. Power saws
   5. Power brushes
   6. Shears
   7. Punches

Provide Demonstrations On:

Use and care of common shop tools and equipment

Provide Practical Application On:

Use and care of shop tools and equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Griffin, Welding Processes
b. Schell and Matlock

Tools and Supplies (or equipment):

Common shop tools and equipment used in welding

CLASSROOM HOURS

80

EVALUATION WLD-3 (continued)

The student will correctly identify and demonstrate the proper use and care of common tools and equipment used in welding.

TASK

WLD-3 Using welding related shop tools

PERFORMANCE OBJECTIVE

Demonstrate the proper and safe use and care of welding related hand and powered tools and equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Proper care and use of common hand tools
   1. Hammers
   2. Hand saws
   3. Chisels and punches
   4. Brushes
   5. Files
   6. Marking tools
   7. Rules, straight edges, squares, dividers, etc.
b. Proper care and use of common powered tools and equipment
   1. Chipping hammer
   2. Drills
   3. Grinders
   4. Power saws
   5. Power brushes
   6. Shears
   7. Punches

Provide Demonstrations On:

Use and care of common shop tools and equipment

Provide Practical Application On:

Use and care of shop tools and equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Griffin, Welding Processes
b. Schell and Matlock

Tools and Supplies (or equipment):

Common shop tools and equipment used in welding

CLASSROOM HOURS

80

EVALUATION WLD-3 (continued)

The student will correctly identify and demonstrate the proper use and care of common tools and equipment used in welding.

TASK

WLD-4 Identifying and preparing metals for welding

PERFORMANCE OBJECTIVE

Describe the chemical, physical and mechanical properties of metals important to welders, the methods for preparing metals, and spark testing methods for identifying metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Metals important to welders
   1. Low carbon steel
   2. Medium carbon steel
   3. High carbon steel
   4. Stainless steel
   5. Manganese
   6. Grey cast iron
   7. Malleable cast iron
   8. Copper
   9. Brass
   10. Bronze
   11. Lead
   12. Aluminum
   13. Magnesium
   14. White metals
   15. White cast iron

(Continued on back)

Provide Demonstration On:

a. Samples of different types of metals
b. Identifying metals by testing

Provide Practical Application On:

Spark testing
1. Brass
2. Steel
3. Cast iron

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Welding Processes
d. Oregon

A/Vs:

Georgia, Slide/Tape (A-7), "Metallurgy"

Student Manuals:
Georgia, Welding, Phase A, Unit 7

Equipment:

a. 1 brass welding rod
b. 1 steel welding rod
c. 1 cast iron welding rod
d. Safety shield
e. Gloves
f. Metal plates

CLASSROOM HOURS

35

Task WLD-4 (Continued)

Provide Information On: (continued)

b. Physical properties of metals
    1. Tensile strength
    2. Ductility
    3. Brittleness
    4. Stress and strain
    5. Elasticity
    6. Compression strength
    7. Fatigue strength
    8. Toughness
    9. Hardness
    10. Corrosion resistance
    11. Weldability
    12. Elongation
    13. Malleability
c. Chemical properties
    1. Composition
    2. Melting point
d. Mechanical properties
    1. Effect of heat on metals
    2. Effect of cold on metals
    3. Relationship to physical properties
e. Spark testing
    1. Method
    2. Meaning of:
        - Color of spark stream
        - Length of spark stream
        - Number of explosions (spurts or sprigs)
        - Shape of explosions (forked or repeating)
    3. Spark testing chart
f. Other tests
    1. Ocyacetylene cutting torch test
    2. Magnetic test
    3. Ring test
    4. Chipping test
    5. Filing test
    6. Fracture test
    7. Functional test
    8. Chemical tests
g. Identification of structural shapes
    1. Sheet and plate - hot and cold rolled
    2. Bars
        - Hot and cold rolled
        - Square - hot and cold rolled
        - Round
        - Hexagon or octagon
        - Half round on oval
        - Angle bars
        - Zee bars

EVALUATION WLD-4 (continued)

a. Given samples of the fifteen types of metals listed in this unit, the student will correctly identify each sample by name and by its physical, mechanical and chemical properties.

b. Test items are available in Welding, Instructor Guide, Vol. III, Written Test A-7, Georgia Department of Education.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

3. Standard I-beam
4. H- beam
5. Wide flange beam
6. Channel
7. Ship channel
8. Standard pipe
9. Tubing
10. Square tubing
11. Rectangular tubing
12. Functions and characteristics and specification of structural shapes

h. Meaning of gage
   U.S. Standard manufactured thickness for steel

i. Preparing metals for welding
   1. Cleaning
   2. Preparing edges
      -Chamfer
      -Bevel
      -Root opening
      -Bevel on both sides
      -Welding joint on both sides
      -When to use edge types
      -How to make edge types

j. Heat treating process
   1. Annealing
   2. Hardening
   3. Case hardening

DO NOT RUN THIS PAGE

TASK

WLD-5 Measuring welding materials

PERFORMANCE OBJECTIVE

Demonstrate ability to measure and mark materials accurately within 1/16 inch.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Measurement equipment
   - Rulers (steel rule)
   - Straight edges
   - Squares
   - Soap stone markers
   - Micrometers (Vernier micrometer)
   - Vernier calipers
   - Dial indicators
   - Telescope & small hole gauges
   - Use of equipment
   - Function of equipment
   - Degree of accuracy

b. Measurement techniques
   - Obtaining accuracy

c. English and metric measuring units
   - Decimals
   - Fractions
   - Conversions

Provide Demonstrations On:

Types of measurement instruments, their operation and uses

Provide Practical Application On:

Marking a metal for cutting and welding

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide

b. Oregon

Student Manuals:

Georgia, Welding, Phase A, Unit A-7A

Equipment:

a. 1 piece of light gage sheet metal at least 5" x 7"
b. 1 square
c. 1 piece of soap stone
d. Ruler
e. Straight edges
f. Micrometer
g. Calipers
h. Telescope and small hole gauges

CLASSROOM HOURS

7

EVALUATION WLD-5 (continued)

Given proper equipment, measure a length of metal to the nearest 1/16 inch; mark off 6 parallel lines spaced within 1/16 inch of given dimensions.

TASK

WLD-6 Using clamps and jigs

PERFORMANCE OBJECTIVE

Demonstrate the proper use of clamps and jigs for holding metals to be welded.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The importance of clamps and jigs
b. Using C-clamps
c. Jigs for butt joints
d. Jigs for corner joints
e. Jigs for T-joints
f. Using copper inserts
g. Backing bars
h. Heat sinks
i. Positioning pipe

Provide Demonstrations On:

Different types of jigs and their uses.

Provide Practical Application On:

Properly setting up joints for welding using appropriate clamping and jigs

INSTRUCTIONAL MATERIALS

Textbooks:

Griffin, Basic TIG & MIG

Tools and Supplies (or equipment):

a. C-clamps
b. Butt joint jig
c. Corner joint jig
d. T-joint jig
e. Pipe joint jig
f. Heat sinks
g. Backing bars
h. Copper inserts
i. Various metals to be clamped

CLASSROOM HOURS

7

EVALUATION

WLD-6 (continued)

Given one or more of each of the types of clamps and jigs covered in this unit, the student will demonstrate the correct use of clamps and jigs in setting up metals for standard joint welds.

TASK

WLD-7 Reading blueprints

PERFORMANCE OBJECTIVE

Read and interpret blueprints and correctly match finished products with blueprint requirements.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of blueprints
b. Basic lines
c. Basic views
d. Notes and specifications
e. Dimensions
f. Structural shapes
g. Auxiliary views
h. Sections
i. Detail and assembly prints
j. Welding abbreviations and symbols
k. Fabrication

Provide Demonstrations On:

Completed projects and their corresponding blueprints

Provide Practical Application On:

a. Reading and interpreting blueprints
b. Matching blueprints with finished products

INSTRUCTIONAL MATERIALS

Textbooks:

Bennett

Tools and Supplies (or equipment):

a. Assorted blueprints
b. Completed welding projects and their corresponding blueprints

CLASSROOM HOURS

80

EVALUATION WLD-7 (continued)

Given a set of blueprints and their corresponding finished products, the student will accurately interpret blueprints and match blueprint requirements with finished products.

TASK

OXA-1 Following safety procedures and regulations for oxyacetylene welding

PERFORMANCE OBJECTIVE

Demonstrate knowledge of safety hazards, accident prevention, safety regulations and safety equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. General safety precautions for welding
b. Safety hazards
   1. Causes for explosions
   2. Fire hazards
   3. Handling hot metals
   4. Toxic fumes
c. Safety equipment
   1. Protective clothing
   2. Fire extinguishers
   3. Safety devices on equipment
d. Shop safety rules
   1. Safety habits and regulations
   2. Cleanliness
   3. Fire prevention
   4. Safe placement and handling of equipment
e. What to do in case of an accident

Provide Demonstrations On:

Types and uses of safety equipment

Provide Practical Application On:

Using fire extinguishers

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse

A/Vs:

a. Georgia, Slide/Tape (A-5A), "Safety"
b. Georgia, Slide/Tape (A-5B), "Safety"

Student Manuals:

Georgia, Welding, Phase A, Unit 5

Equipment:

a. Fire extinguishers
b. Protective clothing
c. Oxyacetylene equipment

CLASSROOM HOURS

4

EVALUATION OXA-1 (continued)

a. Given the types of equipment used in oxyacetylene welding, the student will demonstrate safe practices in handling and using the equipment.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-5, Georgia Department of Education.

TASK

OXA-2 Using Oxyacetylene cylinders and gases

PERFORMANCE OBJECTIVE

Demonstrate a knowledge of cylinders and gases used in oxyacetylene welding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Gases and their properties
   1. Oxygen
   2. Acetylene
   3. Other gases
b. Gas cylinders
   1. Operating instructions
   2. Safety precautions
   3. Care and maintenance
      - Cleaning
      - Testing for leaks
      - What to do if equipment needs repair
      - Transporting and handling
c. Safety rules in using gases

Provide Demonstration On:

Correct handling of cylinders and the use of safety chains

Provide Practical Application On:

Testing for leaks

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-2), "Cylinders and Gases"

Student Manuals:

Georgia, Welding, Phase A Unit 2

CLASSROOM HOURS

7

EVALUATION

OXA-2 (continued)

a. Given a set of oxyacetylene cylinders, hoses, regulators and related apparatus, the student will demonstrate correct procedures for handling, storage and leak testing.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-2, Georgia Department of Education.

c. V'TECS, Performance Guide, Tasks 39 and 41.

TASK

OXA-3 Inspecting oxygen and acetylene regulators

PERFORMANCE OBJECTIVE

Demonstrate ability to identify parts of oxygen and acetylene regulators and describe the function of each regulator part.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Oxyacetylene regulators
   1. Individual parts
   2. How it operates
      - Turning on valves
      - Reading gauges
   3. Safety precautions and hazards
   4. Purpose of regulator
   5. Capacity of regulator

Provide Demonstrations On:

Disassembly, inspection and reassembly of regulators

Provide Practical Application On:

Disassembly, inspection and reassembly of regulators

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-3), "Regulators"

Student Manuals:

Georgia, Welding, Phase A, Unit 3

Equipment:

a. Vice
b. Screwdrivers
c. Adjustable wrench
d. Box end wrench set
e. Demonstration single stage regulator

CLASSROOM HOURS

7

EVALUATION OXA-3 (continued)

a. Given the equipment listed for this task, the student will correctly disassemble the regulator, identify the parts and reassemble the regulator according to procedures covered in this unit.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-3, Georgia Department of Education.

c. V-TECS, Performance Guide, Tasks 39 and 41.

TASK

OXA-4 Selecting and maintaining oxyacetylene torches and tips

PERFORMANCE OBJECTIVE

The student will correctly select the proper size tip and torch for a given job and demonstrate the correct procedures for maintaining tips.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Torch parts
    1. Body or torch handle
    2. Needle valves
    3. Mixer
    4. Tip
b. Function of parts
c. Types of torches
    1. Injector torch
    2. Equal pressure torch
    3. Function of each type
d. Tip
    1. Care
    2. Sizes - chart of tip sizes
    3. Drilling and cutting tips

Provide Practical Application On:

Selecting and cleaning torches and tips

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-4), "Torches and Tips"

Student Manuals:

Georgia, Welding, Phase A, Unit 4

Equipment:

a. Welding tips
b. Tip drills
c. Tip cleaners
d. Injector torch
e. Equal pressure torch

CLASSROOM HOURS

4

EVALUATION OXA-4 (continued)

a. Given specifications for different types of welding jobs, the student will correctly select the proper size and type tip for each job.

b. The student will demonstrate the proper procedures for maintining torch tips.

c. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-4, Georgia Department of Education.

d. V-TECS, Performance Guide, Task 42.

TASK

OXA-5 Setting up and lighting the oxyacetylene torch

PERFORMANCE OBJECTIVE

Demonstrate a safe and correct procedure in setting up and lighting an oxyacetylene torch, shutting down the torch and caring for equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Sequence of the torch lighting process
b. Lighting the torch and adjusting the flame
c. Sequence of the depressurizing process
c. Flame types
    1. Neutral
    2. Carburizing
    3. Oxidizing
    4. Function of each flame type
    5. Flame zones
        - Cone
        - Envelope
        - Feather
e. Care and maintenance of equipment

Provide Demonstration On:

Correct torch lighting and shut-down procedures

Provide Practical Application On:

Setting up and lighting the torch

1. Setting up the apparatus
2. Lighting and adjusting the torch
3. Shutting down the apparatus

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-6), "Setting Up and Lighting The Torch"

Student Manuals:

Georgia, Welding, Phase A, Unit 6

Equipment:

Oxyacetylene welding apparatus

CLASSROOM HOURS

4

EVALUATION OXA-5 (continued)

a. Given proper equipment set up and light a torch for welding; adjust to a neutral flame, a carburizing flame and an oxidizing flame; shut down torch and secure equipment according to approved procedures.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-6, Georgia Department of Education.

TASK

OXA-6 Carrying a puddle without a filler rod

PERFORMANCE OBJECTIVE

Using oxyacetylene welding apparatus, control a puddle without a filler rod.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
   1. Beads
   2. Filler rods
   3. Puddle
   4. Carrying a puddle
   5. Torch motion
      - Circular
      - Zig Zag
      - Alternating rod
      - Zipper
      - Oscillating
   6. Forehand welding
   7. Backhand welding

b. Characteristics that guide proper puddling of a metal
   1. Penetration
   2. Torch adjustment
   3. Torch handling
   4. Torch movement
   5. Torch speed
   6. Angle of torch to metal

c. Appearance of puddle surface

Provide Demonstration On:

Method of carrying a puddle without a rod

Provide Practical Application On:

Making a plate with four beads without a filler rod

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-8), "Carrying a Puddle Without a Rod"

Student Manuals:

Georgia, Welding, Phase A, Unit 8.

Equipment:

a. Oxyacetylene welding apparatus
b. Light gage mild steel plate

CLASSROOM HOURS

12

EVALUATION OXA-6 (continued)

Using proper oxyacetylene equipment, produce one 4" x 6" plate with 4 beads 5 inches long without using a filler rod. These beads must be straight, uniform and evenly spaced.

TASK

OXA-7 Welding an outside corner joint without a filler rod, using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Weld an outside corner joint in 4 positions (flat, horizontal, vertical and overhead) without a filler rod, using oxyacetylene equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
   1. Corner joint
   2. Base metal
   3. Weld
   4. Groove
   5. Fillet welds
b. Procedure for welding corner joint
   1. Torch angle
   2. Motion of torch
   3. Torch speed
   4. Flame type
c. Positioning of metals to each other
d. Standard for a good joint
e. Testing joints
f. When to weld joints without a rod (thin gage metals)

Provide Demonstration On:

a. Examples of good corner joint welds
b. Proper welding technique
c. Errors and their causes

Provide Practical Application On:

Welding an outside corner joint in the flat, horizontal, vertical and overhead position without the use of a filler rod

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-9), "Welding an Outside Corner Joint"

Student Manuals:

Georgia, Welding, Phase A, Unit 9

Equipment:

a. Oxyacetylene welding apparatus
b. Light gage mild steel plate

CLASSROOM HOURS

16

EVALUATION OXA-7 (continued)

a. Using proper oxyacetylene equipment, weld an outside corner joint in flat, horizontal, vertical, and overhead positions. The joints should be uniform in appearance and have complete penetration and fusion.

b. V-TECS, Performance Guide, Task 19.

TASK

OXA-8 Making beads with filler rods, using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Demonstrate ability to produce a plate of beads with a filler rod using oxyacetylene welding apparatus.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Filler rods
   1. Types and sizes
   2. When to use
   3. Selecting the correct filler rod

b. Using the rod correctly
   1. Angle and motion of rod
   2. Distance from torch and metal

c. Errors and their causes
   1. Burn through
   2. Chilling puddle
   3. Failure to absorb enough heat

d. Correct use of the torch

Provide Demonstration On:

a. Examples of good bead welds
b. Examples of poor welds and their causes

Provide Practical Application On:

Making a plate of beads with a filler rod

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

Student Manual:

Georgia, Welding, Phase A, Unit 10

Equipment:

a. Oxyacetylene welding apparatus
b. 2 pieces of light gage sheet metal approximately 4" x 6", 1/16" or 3/32" filler rod

CLASSROOM HOURS

16

EVALUATION OXA-8 (continued)

Using oxyacetylene welding equipment, produce two 4" x 6" plates of beads with a filler rod, with 4 beads 5" long on each plate. The beads must be straight, evenly spaced and conform to specifications.

TASK

OXA-9 Welding butt joints using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Demonstrate ability to weld proper butt joints in the 4 positions (flat, horizontal, vertical and overhead) using oxyacetylene welding apparatus and various gages of mild steel plate

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and uses of butt joints
b. Edge preparation
c. Selection of filler rod
d. Welding technique
   1. Torch adjustment
   2. Torch angle and motion
   3. Correct use of the filler rod
e. Specifications for a good weld
f. Types of butt joint
   - Open
   - Closed
g. Terminology
   1. Crown
   2. Direction of weld or direction of travel

(Continued on Back)

Provide Demonstration On:

a. Examples of good and bad butt welds
b. Proper welding technique

Provide Practical Application On:

Welding a strong butt joint in the four welding positions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

a. Georgia, Slide/Tape (A-11), "Welding in a Flat Position"
b. Georgia, Slide/Tape (A-12), "Vertical and Overhead Welding"

Student Manual:

Georgia, Welding, Phase A, Units A-11 and A-12

Equipment:

a. Oxyacetylene apparatus
b. Steel filler rods
c. Mild steel plate of various gages

CLASSROOM HOURS

30

EVALUATION OXA-9 (continued)

a. Using oxyacetylene welding apparatus, weld 2 butt joints on one side only. The plates will be approximately 4" wide and 5" long. The welds will be done in 4 positions (flat, horizontal, vertical, overhead). One joint will be bent in a vice to check penetration and fusion. All joints will be checked for appearance.

b. V-TECS, Performance Guide, Tasks 18,20,21,22,23,26,29 and 34.

INSTRUCTIONAL ACTIVITIES

Provide Information On: (Continued)

h. Errors/causes
   1. Uneven weld bead/incorrect speed
   2. Holes in joint/holding flame in one spot too long
   3. Brittle weld/improper flame adjustment
   4. Excessive metal sag/too much penetration
   5. Insufficient penetration/too rapid torch speed
   6. Hole in end of joint/not lifting torch when end reached
   7. Weak joint even though have correct penetration
      - Holding torch too flat
      - Filling space with rod and not melting base metal sufficiently
      - Improper space between the edges of the plate

TASK

OXA-10 Welding lap joints using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Demonstrate ability to weld a lap joint in horizontal, vertical, flat and overhead positions using oxyacetylene welding apparatus and various gages of mild steel plate

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of lap joint
b. Edge preparation
c. Positioning of metals
d. Selection of filler rod
e. Welding technique
    1. Torch adjustment
    2. Torch angle and motion
    3. Correct use of the filler rod
f. Specifications for a good weld
g. Errors and their causes

Provide Demonstration On:

a. Examples of good and bad lap joint welds
b. Proper welding technique

Provide Practical Application On:

Welding lap joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
3. Oregon

Student Manuals:

Georgia, Welding, Phase A, Unit 12

Tools and Supplies (or equipment):

a. Oxyacetylene welding apparatus
b. Steel filler rod
c. Mild steel plate, various gages

CLASSROOM HOURS

20

EVALUATION OXA-10 (continued)

a. Using oxyacetylene welding apparatus the student will weld lap joints in the horizontal, vertical, flat and overhead positions with proper surface appearance and complete root penetration. Joints must be 6" long and tested by bending in a vice to a 90° angle.

b. V-TECS, Performance Guide, Task 24

TASK

OXA-11 Welding T-joints using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Given an oxyacetylene welding apparatus, weld T-joints in the horizontal, vertical, flat and overhead positions using a filler rod.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types and uses of T-joints
b. Edge preparation
c. Positioning of metals
d. Selection of filler rod
e. Welding technique
    1. Torch adjustment
    2. Angle, motion and speed of torch
    3. Correct use of the filler rod
f. Specifications for a good weld
g. Errors and their causes

Provide Demonstrations On:

a. Examples of good and bad T-joints and reasons for errors
b. Proper welding technique

Provide Practical Application On:

Welding T-joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-13), "Welding T-Joints"

Student Manuals:

Georgia, Welding, Phase A, Unit A-13

Tools and Supplies (or equipment:

a. Oxyacetylene apparatus
b. Steel welding rods
c. Mild steel plates, various gages

CLASSROOM HOURS

35

EVALUATION OXA-11 (continued)

a. Given oxyacetylene welding equipment and appropriate materials weld T-joints in horizontal, vertical, flat and overhead positions using a filler rod. All welds should meet standards in clean appearance, uniform bead, equal distribution of metal on each surface and complete penetration and fusion. All welds will be bent and checked for penetration.

b. V-TECS, Performance Guide, Task 17.

TASK

OXA-12 Setting up the oxyacetylene apparatus for flame cutting

PERFORMANCE OBJECTIVE

Given the specifications for an oxyacetylene flame cutting job, the student will select the proper equipment and set up the apparatus for the job.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. The principle of oxidation
   1. The effect on metals
   2. The effect of heat
   3. Ferrous metals
   4. Properties of different metals
   5. The effect of metal thickness
b. Cutting torches and apparatus
   1. Manual torch types
      - one piece
      - combination
   2. Needle valves
   3. Cutting tips
   4. Care and maintenance of equipment

Provide Demonstration On:

Examples of different types of cutting torches and apparatus

Provide Practical Application On:

Selecting and setting up torches and equipment for a flame cutting job

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-14)
"The Flame Cutting Process"

Student Manuals:

Georgia, Welding, Phase A, Unit A-14

Tools and Supplies (or equipment):

One piece and combination oxyacetylene cutting torches and apparatus

CLASSROOM HOURS

5

EVALUATION OXA-12 (continued)

a. Given specifications for an oxyacetylene cutting job the student will select the proper equipment and set up the apparatus for the job.

b. Test items are available in Welding, Instructor Guide, Vol. II, Written Test A-14, Georgia Department of Education.

TASK

OXA-13 Cutting with an oxyacetylene cutting torch

PERFORMANCE OBJECTIVE

Light an oxyacetylene cutting torch and make standard welding cuts on mild steel plate, round solids and pipe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Selecting the correct torch and apparatus
b. Preparing metals
c. Technique for cutting straight lines
d. Cutting circles
    1. Freehand cutting
    2. Using an attachment
    3. Torch adjustment
    4. Angle, speed and motion of torch
    5. Punch marking lines
    6. Ring cutting
e. Bevel Cutting
    1. Tip size
    2. Using a guide bar
    3. Torch adjustment

Provide Demonstration On:

a. Examples of good cuts
b. Proper cutting techniques
c. Errors and their causes

Provide Practical Application On:

a. Setting up and lighting a torch
b. Straight line cutting
c. Bevel cutting
d. Circle cutting
e. Round stock cutting
f. Proper cleaning of equipment

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-15), "Cutting a Straight Line"

Student Manuals:

Georgia, Welding, Phase A, Unit A-15

Tools and Supplies (or equipment):

a. Oxyacetylene cutting apparatus
b. Cutting attachment
c. Various gages of mild steel plate, round solids and pipe

CLASSROOM HOURS

20

EVALUATION OXA-13 (continued)

a. Given an oxyacetylene cutting torch, measuring equipment and other proper materials and equipment:
   a. Correctly set up and light a cutting torch
   b. Cut five straight, smooth strips of metal
   c. Cut a circle - should be perfectly round and smooth
   d. Cut a ring - should be round and smooth
   e. Cut a beveled edge
      1. Finished surface of edge should have perpendicular drag lines
      2. Top and bottom edge should be well defined
   f. Cut a section of a solid shaft
   g. Cut a section of pipe

   All cutting should have smooth clean appearance and be free of slag.

b. V-TECS, Performance Guide, Task 43.

Provide Information On: (continued)

   4. Angle, motion and speed of torch
   5. Degrees of beveling

f. Cutting round stock with the manual torch
   1. Torch adjustment
   2. Angle, motion and speed of torch
   3. Tip size for cutting
      - Pipe
      - Round solids
   4. Starting the cut

TASK

OXA-14 Piercing and cutting holes using the oxyacetylene cutting torch

PERFORMANCE OBJECTIVE

Demonstrate ability to layout and cut smooth slag free holes using oxyacetylene cutting apparatus

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Procedures for piercing small holes
   1. Correct tip size
   2. Flame type
   3. Tip movement
      - Slow spiral motion
   4. Obtaining desired hole diameter
b. Procedure for cutting larger holes
   1. Mark line to be cut
   2. Cut small hole inside hole to be cut
   3. Cut from small hole to cutting line
   4. Continue around line
   5. Perpendicular tip angle to metal plate

(Continued on back)

Provide Demonstration On:

a. Proper piercing and cutting technique
b. Errors and their causes

Provide Practical Application On:

Piercing and cutting holes
   1. Setting up equipment
   2. Preparing metal and equipment for cutting
   3. Laying out work
   4. Lighting torch
   5. Piercing and cutting proper holes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-16), "Cutting and Piercing Holes"

Student Manuals:

Georgia, Welding, Phase A, Unit A-16

Equipment:

a. Cxyacetylene cutting apparatus
b. Mild steel plate, various gages
c. Assorted tools

CLASSROOM HOURS

21

EVALUATION OXA-14 (continued)

Given oxyacetylene hole cutting equipment and proper materials:

a. Set up cutting equipment
b. Layout 3 holes 2" in diameter
c. Make smooth, slag free cuts

Provide Information On: (continued)

c. Alternate procedures for cutting large holes
c. Sizing holes accurately
   - Using a tapered punch

TASK

OXA-15 Cutting with an automatic oxyacetylene cutting machine

PERFORMANCE OBJECTIVE

Demonstrate ability to layout and cut smooth and slag free cuts using automatic cutting machine.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of machines
   1. For straight line cutting
   2. For shape cutting
b. Attachments to machines
c. Locating machines
d. Starting machine
e. Operating machine
f. Shutting down machine
g. Cutting procedure with machine
h. Travel speeds - chart
i. Cutting torch operating data - chart
j. Cutting a straight line
   1. Assembling with correct torches & tips
   2. Starting machine - operating controls
k. Circle cutting
   - Inserting radius rod
l. Bevel cutting

Provide Demonstration On:

Operating the cutting machine, and cutting a straight line, circle, and a beveled edge

Provide Practical Application On:

a. Setting up cutting machine
b. Making a straight line cut
c. Making a beveled edge cut
d. Cutting a circle

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Althouse
c. Cutting machine manual
d. Oregon

A/Vs:

Georgia, Slide/Tape (A-17), "Setting up the Automatic Cutting Machine"

Student Manuals:

Georgia, Welding, Phase A, Unit A-17

Equipment:

a. Oxyacetylene straight line automatic cutting machine
b. Radius rod attachment
c. Mild steel plate, various gages

CLASSROOM HOURS

15

EVALUATION OXA-15 (continued)

Given a straight line automatic cutting machine and proper materials the student will:

a. Set up machine
b. Make 3 straight, smooth, slag free cuts
c. Insert radius rod
d. Cut out one smooth slag free circle
e. Cut one smooth, even, beveled edge
f. Shut down machine

TASK

OXA-16 Welding beads with brass rods using oxyacetylene welding equipment

PERFORMANCE OBJECTIVE

Using oxyacetylene welding apparatus and brass rods, the student will demonstrate proper procedure for running beads on steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definition of brazing
b. How brazing works
c. Repairing
d. Joining certain metals
   - Cast iron
   - Malleable brass
   - Copper
   - Steel tubing to cast iron
   - Copper tubing to steel
   - Tool steel to low carbon steel
e. Advantages and disadvantages
f. Purpose and use of flux
g. Tip selection
h. Brazing rod selection

(Continued on back)

Provide Demonstration On:

a. Examples of different uses of brazing
b. Proper brazing technique
c. Errors and their causes

Provide Practical Application On:

a. Brazing beads on steel plate
b. Brazing copper tubing to steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

A/Vs:

Georgia, Slide/Tape (A-18), "Running Beads With A Brass Rod"

Student Manuals:

Georgia, Welding, Phase A, Unit A-18

Tools and Supplies (Or equipment:

a. Oxyacetylene welding apparatus
b. Flux coated brass rods
c. Mild steel plate 1/8" thick
d. Pieces of copper tubing

CLASSROOM HOURS

16

EVALUATION OXA-16 (continued)

a. Given oxyacetylene welding equipment and brass rods and materials:
   1. Set up welding equipment
   2. Run two 9" long beads on 2" wide steel plate according to proper specifications
   3. Good brazing welds should be as strong as the base metal

b. Written test items available in Welding, Instructor Guide, Vol. II, Written Test A-18, Georgia Department of Education.

Provide Information On: (continued)

i. Brazing technique
   1. Torch adjustment
   2. Tinning
   3. Rod angle
   4. Torch angle, motion and speed
   5. Temperature control

j. Errors and their causes

TASK

OXA-17 Brazing a lap joint using oxyacetylene apparatus

PERFORMANCE OBJECTIVE

Demonstrate ability to braze lap joints with uniform appearance and correct depth of bond

INSTRUCTIONAL ACTIVITIES

Provide Information On:

Bronzing process
1. Tip selection
2. Tinning action
3. Control of flow of filler metal - flame angle
4. Types of filler metals
5. Cleaning surface to be welded

Provide Practical Application On:

Brazing a lap joint

Related Applications:

Welding unlike metals

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Griffin, Basic Oxyacetylene
d. Althouse
e. Oregon

Student Manual:

Georgia, Welding, Phase A, Unit A-19

Equipment:

a. Oxyacetylene welding equipment
b. 3/32" or 1/8" flux coated brass rod
c. 4 pieces 1/16" or 1/8" steel 2" x 6"

CLASSROOM HOURS

20

EVALUATION OXA-17 (continued)

a. Given oxyacetylene welding equipment, flux coated brass rods and proper materials, set up equipment and braze 2 joints with proper appearance. One joint will be checked for appearance and one joint will be checked by breaking for depth of bond.

b. Written items are available in Welding, Instructor Guide, Vol. II, Written Test A-19, Georgia Department of Education.

c. V-TECS, Performance Guide, Task 40.

TASK

OXA-18 Brazing with silver using oxyacetylene equipment

PERFORMANCE OBJECTIVE

Silver braze various metals using oxyacetylene equipment

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Grades of silver alloy
   1. Easy flow
   2. Medium flow
   3. Hard flow
b. Characteristics
   1. Low tensile strength
   2. Corrosion resistance
   3. High electrical conductivity
c. Silver alloys chart
   1. Composition
   2. Melting/flowing point
   3. Uses
   4. Special alloys

(continued on back)

Provide Demonstrations On:

a. Examples of good and bad brazing

b. Proper brazing procedures

Provide Practical Application On:

Silver brazing various metals and types of joints

INSTRUCTIONAL MATERIALS

Textbooks:

Oregon

Tools and Supplies (or equipment):

a. Oxyacetylene welding apparatus
b. Parts to be brazed
c. Flux
d. Silver brazing filler metal (wire or ribbon)
e. Assorted tools

CLASSROOM HOURS

20

EVALUATION (OXA-18)

Given proper silver brazing materials and equipment, braze a proper lap joint that has a good clean appearance. Test the joint for strength.

Provide Information On: (continued)

d. Uses of silver brazing
    1. Fastening carbide inserts
    2. Assembling computer parts
    3. Connecting pipe and tubing
    4. Assembling small stamped parts
    5. Fabricating firearm parts
    6. Jewelry and artwork
    7. Fabricating odd parts
e. Method of brazing
    1. Preparing metals
    2. Fluxing
    3. Flame adjustment
    4. Using the filler metal
    5. Using the torch
f. Toxic fumes

TASK

OXA-19 Soldering

PERFORMANCE OBJECTIVE

Solder copper, sheet metal and other metals using oxyacetylene equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of soldering
b. Types of solder
   - tin and lead
   - silver
c. Types of fluxes and their uses
   1. Corrosive
   2. Non-corrosive
d. Advantages and disadvantages of soldering
e. Types of joints
   1. Tolerance
   2. Strength
   3. Joint design

(continued on back)

Provide Demonstrations On:

a. Examples of good soldered joints
b. Examples of soldering errors and their causes
c. Proper soldering technique

Provide Practical Application On:

Soldering various metals and different kinds of joints using various types of solder

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Althouse
c. Oregon

A/Vs:

Georgia, Slide/Tape (A-20), "Silver Soldering Process"

Student Manuals:

Georgia, Welding, Phase A, Unit A-20

Tools and Supplies (or equipment):

a. Oxyacetylene welding equipment
b. Solder, various types
c. Flux
d. Various metals to be soldered
e. Assorted tools

CLASSROOM HOURS

20

EVALUATION (OXA-19)

a. Given copper tubing, steel sheet metal, solder and oxyacetylene welding equipment, solder two pieces of copper tubing to a piece of sheet metal. Joints must have an even bond around the tubing inside and outside the joint.

b. V-TECS, Performance Guide, Task 50.

Provide Information On: (continued)

f. Soldering equipment
   1. Soldering copper
   2. Electric soldering copper
   3. Electric soldering gun
   4. Gas furnaces for heating soldering coppers
   5. Propane torch

g. Cleaning and soldering a joint
   1. Heating the base metal
   2. Tinning a copper
   3. Fluxing
   4. Applying solder

h. Soldering technique
   1. Soldering seams
   2. Sweat soldering
   3. Wire connections

TASK

OXA-20 Welding cast iron using oxyacetylene apparatus

PERFORMANCE OBJECTIVE

Demonstrate ability to weld cast iron using oxyacetylene apparatus

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Preparation of casting
   1. Remove "Casting Skin"
   2. Grinding a V
b. Welding process
   1. Fusion - heat metal to melting point to start weld
   2. Flame - neutral
   3. Flux
   4. Angle and motion of torch
c. Post heat and cooling process
   - Cooling slowly
d. Errors and their causes

Provide Practical Application On:

Welding a cast iron butt joint

Related Applications:

Brazing Cast Iron

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino & Weeks
c. Althouse

A/Vs:

Georgia, Slide/Tape (A-21), "Welding in Cast Iron"

Student Manual:

Georgia, Welding, Phase A, Unit A-21

Equipment:

a. Oxyacetylene welding apparatus
b. Two pieces of cast iron
c. Cast iron filler rod with flux
d. Assorted tools

CLASSROOM HOURS

10

EVALUATION OXA-20 (continued)

a. Given oxyacetylene welding apparatus, cast iron, cast iron filler rod and flux and other proper equipment, weld a cast iron butt joint. Have correct penetration and uniform appearance.

b. V-TECS, Performance Guide, Task 45.

TASK

OXA-21 Cutting and welding pipe using oxyacetylene apparatus

PERFORMANCE OBJECTIVE

Demonstrate ability to cut and weld pipe using oxyacetylene apparatus.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Method for cutting pipe
   1. Wrap around - to maintain straight line
   2. Mark pipe with soap stone
   3. Center punch on line every 1/2"
   4. Using channel
   5. Proper tip sizes
   6. Torch angle & motion
   7. Flame - neutral
   8. Pipe cutting technique
b. Beveling pipe
   - Torch angle & motion
c. Selecting filler rod

(Continued on back)

Provide Demonstration On:

a. Examples of good welds
b. Examples of errors and their causes
c. Proper welding technique

Provide Practical Application On:

Cutting pipe and making a butt weld

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Althouse
d. Oregon

A/Vs:

Georgia, Slide/Tape (A-22), "Pipe Welding"

Student Manuals:

Georgia, Welding, Phase A, Unit A-22

Equipment:

a. Oxyacetylene welding apparatus
b. Filler rod
c. Pieces of pipe
d. Assorted tools

CLASSROOM HOURS

30

EVALUATION OXA-21 (continued)

a. Given oxyacetylene welding equipment, pipes and other proper equipment, make butt welds on pipe 2" and smaller in the rolled and fixed position. Have correct penetration and bead appearance.

b. V-TECS, Performance Guide, Task 83.

Provide Information On: (continued)

d. Welding pipe
   1. Preparing and positioning pieces of pipe
   2. Rolling method
   3. Angle and motion of torch
   4. Using the filler rod

TASK

ARC-1 Selecting and setting up shielded arc welding apparatus

PERFORMANCE OBJECTIVE

The student will demonstrate the ability to correctly select and set up shielded arc welding apparatus to perform jobs of given specifications.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Shielded arc welding terminology
b. Safety regulations and practices
c. What to do in case of accident
d. Types and characteristics of arc welding machines and their applications
e. Welding circuits and currents
   (1) AC/DC
   (2) Amps, volts, ohms
   (3) Polarity
   (4) Grounding
f. Accessories and protective clothing

(continued on back)

Provide Demonstration On:

a. Types of welding machines and accessories
b. Safe and unsafe practices

Provide Practical Application On:

a. Setting up proper welding circuits
b. Identifying and selecting electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Althouse
d. Oregon
e. Griffin, Basic Arc Welding

A/Vs:

a. Georgia, Slide/Tape (B-1), "Introduction to Shielded Arc Welding"
b. Georgia, Slide/Tape (B-2), "Shielded Arc Welding Safety"
c. Georgia, Slide/Tape (B-3), "Identification of Arc Welding Machines"
d. Georgia, Slide/Tape (B-4), "Electrical Circuits"
e. Georgia, Slide/Tape (B-6), "Setting up Welding Machine and Striking an Arc"
f. Georgia, Slide/Tape (B-9), "Identifying and Selecting Electrodes"

(continued on back)

CLASSROOM HOURS

20

EVALUATION ARC-1 (continued)

a. Given a set of job specifications, the student will correctly select and set up the proper arc welding apparatus for performing the job, including selection of the proper electrodes and setting up the welding circuit.

b. Georgia, Welding, Instructor Guide, Vol. II, Written Tests B-1, B-2, B-4A, B-4B, and B-5

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Procedures for setting up apparatus
h. Types of electrodes, their characteristics and uses
   1. Electrode identification and operating data chart
   2. AWS classification system for mild and low alloy steel electrodes
i. Selecting the correct electrode
   1. Finished product specifications
   2. Job conditions and requirements
   3. The effects of current
   4. Properties of metals being welded

INSTRUCTIONAL MATERIALS (continued)

Student Manuals:

Georgia, Welding, Phase B, Units B-1, B-2, B-3, B-4A, B-5, B-6 and B-9

Tools and Equipment:

a. Several types of shielded arc welding machines
b. Arc welding face shield
c. Variety of electrodes
d. Chipping hammer
e. Wire brush
f. Soap stone

TASK

ARC-2 Welding string and weave beads using shielded arc welding apparatus

PERFORMANCE OBJECTIVE

Weld string and weave beads in all four positions (flat, vertical, horizontal and overhead) using shielded metal arc apparatus.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of string and weave beads
b. Selection of electrode
c. Setting of polarity and amperage
d. Preparation of metals
   (1) Cleaning
   (2) Laying out lines
   (3) Clamping, bracing
e. Setting up circuit
f. Method of welding
   (1) Striking an arc
   (2) Angle of electrode
   (3) Arc length
   (4) Motion of electrode
   (5) Direction of travel and speed
   (6) Tacking

(Continued on back)

Provide Demonstration On:

a. The correct appearance of properly welded string and weave beads
b. Recognizing faulty welding and its cause

Provide Practical Application On:

Welding beads in all four positions using various types of electrodes and metals

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Giachino and Weeks
c. Oregon
d. Griffin, Basic Arc Welding

A/Vs:

Georgia, Slide-Tape (B-23), "Weld String and Weave Beads in the Overhead Position"

Student Manuals:

Georgia, Welding, Phase B, Units B-23, B-24, B-34, B-37

Tools and Equipment:

a. AC/DC welding machine
b. Protective clothing
c. Cleaning tools
d. Pliers or vise grips
e. Various electrodes
f. Various gages of mild steel plate

CLASSROOM HOURS

63

EVALUATION ARC-2 (continued)

Given various gages of mild steel plate and arc welding apparatus, the student will set up the equipment, select the proper electrode and weld a series of string and weave beads on plates in the four welding positions of flat, horizontal, vertical and overhead.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Standard for weld
   (1) Bead width
   (2) Rippling
   (3) Uniformity
h. Errors and their causes
   (1) Cold start
   (2) Burn through
   (3) Spattering
   (4) Too high crown
   (5) Break in arc
i. Cleaning finished work
j. Differences in welding procedures for flat, horizontal, vertical and overhead welding positions
k. Welding characteristics of different gage metals.

TASK

ARC-3 Arc welding string beads and padding a plate

PERFORMANCE OBJECTIVE

Arc weld a pad of overlapping beads in the flat, vertical, horizontal, and overhead positions using E6010, E6011 and E6013 electrodes.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Definitions
   (1) Padding a plate
   (2) Beads
   (3) Wash beads
   (4) Tolerance
   (5) Shelf
   (6) Sagging
   (7) Undercutting
b. Method of making a pad of beads
   (1) Motion of weld
      (a) Straight back and forth
      (b) Hooking
      (c) Circular

(Continued on back)

Provide Practical Application On:

Welding a pad of beads
   (a) Welding in all four positions
   (b) Use E6010, E6011 and E6013 electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Geogia, Welding, Instructor Guide
b. Giachino and Weeks
c. Althouse
d. Oregon
e. Griffin, Basic Arc Welding

A/Vs:

a. Georgia, Slide/Tape (B-7), "Welding a Pad of Beads in the Flat Position"

Student Manuals:

Welding, Phase B, Georgia, Units B-7, B-12, B-16, B-18

Tools and Equipment:

a. AC/DC welding machine
b. Protective clothing
c. Cleaning tools
d. Pliers or vice grips
e. 1/8" E6010, E6011, E6013 electrodes
f. 1/4" mild steel plates 5" x 8"

CLASSROOM HOURS

25

EVALUATION ARC-3 (continued)

Given shielded arc welding equipment and other proper materials:

a. Weld a pad of beads:
   (1) Weld in all four welding positions
   (2) Use different electrode types
b. Beads should have:
   (1) Proper width
   (2) Evenness and uniformity
   (3) No cold starts
   (4) Proper crater filling
   (5) Correct overlapping
   (6) No sag or undercut

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

   (2) Welding in the four positions (flat, vertical, horizontal and overhead)
      (a) Arc length
      (b) Speed of travel
      (c) Angle of electrode
      (d) Amperage
c. Adjusting machine
   (1) Electrode types (particularly E6010, E6011, and E6013 electrodes
   (2) Thickness of metal
d. Cleaning work

INSTRUCTIONAL MATERIALS (continued)

A/Vs:

b. Georgia, Slide/Tape (B-16), "Padding a Plate of Beads in the Horizontal Position"
c. Georgia, Slide/Tape (B-18), "Padding a Plate in the Vertical Position"

TASK

ARC-4 Arc welding lap joints

PERFORMANCE OBJECTIVE

Shield arc weld lap joints in the flat, horizontal, vertical and overhead positions using E6010, E6011, E6012, E6013 electrodes and different gage metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Lap joints
   (1) Edge preparation
   (2) Positioning of metals
   (3) Leg dimensions
b. Bead form for lap joints
c. Method for welding various gages of metals
   (1) Electrode selection
   (2) Welding together two different gages of metals
   (3) Welding together the same gage of metal
   (4) Where to direct arc
d. Welding positions
   (1) Flat
   (2) Horizontal

(continued on back)

Provide Demonstration On:

a. Examples of good lap joint welds
b. Errors and their causes
c. Proper welding technique

Provide Practical Application On:

a. Examples of good lap joint welds
b. Errors and their causes
c. Proper welding technique

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Althouse
c. Oregon
d. Schell & Matlock
e. Griffin, Basic Arc Welding

A/Vs:

Georgia, Slide/Tape (B-10), "Welding a Lap Joint in the Horizontal Position"

Student Manuals:

Georgia, Welding, Phase B, Units B-10, B-14, B-20, B-25, B-36, B-39

Tools and Equipment:

a. Sheild arc welding machine
b. Protective clothing
c. Cleaning tools
d. Pliers and vice grips
e. Electrodes E6010, E6011, E6012, E6013, E6024, E7024, E7018
f. Light and medium gage metal

CLASSROOM HOURS

50

EVALUATION ARC-4 (continued)

a. Given shielded arc welding equipment and other proper materials:
   (1) Weld lap joints
      (a) Weld in the four welding positions
      (b) Weld the joint using two different gages of metal to weld together
      (c) Weld different gages of metal, but weld the same gage together
   (2) Joint should have
      (a) Proper penetration and fusion
      (b) Complete fill
      (c) Equal leg dimensions
      (d) Proper beads
      (e, Clean, neat appearance

b. V'TECS, Task 24, Performance Guide

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

   (3) Vertical
   (4) Overhead

e. Welding method for the four positions
   (1) Motion of electrode
   (2) Torch angle and motion
   (3) Machine settings
   (4) Travel speed

f. Welding with different electrodes
   (1) Method of selection and identification
   (2) Machine settings
   (3) Current
   (4) Travel speed
   (5) Types of metals used with electrodes
   (6) Electrode widths

g. Errors
   (1) Weld sag
   (2) Undercut
   (3) Burn through

h. Testing weld joints
   (1) Guided bend testing
   (2) Acid etching
   (3) Destructive tests
   (4) X-ray tests
   (5) Visual tests

TASK

ARC-5 Arc Welding butt joints

PERFORMANCE OBJECTIVE

Shield arc weld butt joints in the flat, horizontal, vertical and overhead positions using E6010, E6011, E6012, E6013, E6024, E7018 and E7024 electrodes and different gage metals.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of butt joints
   (1) Square butt
   (2) Square groove
   (3) Single V groove
   (4) Double V groove
   (5) Single bevel groove
   (6) Double bevel groove
   (7) Single U groove
   (8) Double U groove
   (9) Single J groove
   (10) Double J groove
b. Edge preparation
c. Root opening
d. Bead form and sequence
e. Back up bar
f. Welding different gages of metals

(Continued on back)

Provide Demonstration On:

a. Different types of electrodes and their uses with butt joints
b. Examples of good butt joint welds
c. Examples of poor butt joint welds and the causes

Provide Practical Application On:

Welding butt joints in the four positions using different metals and different electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Althouse
c. Oregon
d. Schell and Matlock
e. Georgia, Welding, Instructor Guide
f. Griffin, Basic Arc Welding

A/Vs:

Georgia, Slide/Tape (B-8), "Welding Butt Joints in the Flat Position"

Student Manuals:

Georgia, Welding, Phase B, Units B-8, B-13, B-17, B-19, B-24, B-27, B-30, B-32, B-35 and B-38

Tools and Equipment:

a. Shielded arc welding machine and apparatus
b. Protective clothing
c. Assorted tools
d. Electrodes E6010, E6011, E6012, E6013, E6024, E7018, E7024
e. Steel plates of mild steel, light gage

CLASSROOM HOURS

70

EVALUATION ARC-5 (continued)

a. Given a shielded arc welding machine and related apparatus and tools, the student will weld various types of square and grooved butt joints in the four positions of flat, horizontal, vertical and overhead, using E6010, E6011, E6012, E6013, E6024, E7018 and E7024 electrodes and various gages of metals. All joints will be free of errors and poor welds.

b. V'TECS, Performance Guides, Tasks 18, 20, 21, 22 and 23

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Welding in different positions
   (1) Flat
   (2) Horizontal
   (3) Vertical
   (4) Overhead
h. Welding techniques
   (1) Motion of electrode
   (2) Electrode angle
   (3) Direction of travel
   (4) Machine settings
   (5) Arc length
i. Errors and their causes
   (1) Weld sag
   (2) Undercut
   (3) Spattering
   (4) Cold start
   (5) Burn through
j. Using different electrodes
   (1) Machine settings
   (2) Travel speed
   (3) Electrode diameter
   (4) Matching with metals
   (5) Welding with E6010, E6011, E6012, E6013, E6024, E7018 and E7024 electrodes
k. Testing weld joints
l. Characteristics of good joints

TASK

ARC-6 Shield arc welding T-fillet joints

PERFORMANCE OBJECTIVE

Shield arc weld T-fillet joints in the flat, horizontal, vertical and overhead positions using E6010, E6011, E6013, E7018 and E7024 electrodes

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
   (1) Fillet joint
   (2) T-fillet joint
   (3) Root beads
   (4) Weave beads
   (5) Multiple passes
   (6) Keyhole effect
b. Welding techniques
   (1) Machine setting
   (2) Electrode angle
   (3) Electrode motion
   (4) Arc length
   (5) Speed of travel
   (6) Direction of travel

(Continued on back)

Provide Demonstration On:

a. Examples of properly welded joints
b. Examples of poor welding and the causes

Provide Practical Application On:

Welding T-joints in the four welding positions using various metals and various electrodes

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Althouse
c. Oregon
d. Schell and Matlock
e. Georgia, Welding, Instructor Guide
f. Griffin, Basic Arc Welding

Student Manuals:

Georgia, Welding, Phase B, Units B-11, B-15, B-21, B-22, B-26, B-31 and B-33

Tools and Equipment:

a. AC/DC welding machine and apparatus
b. Protective clothing
c. Assorted tools
d. Electrodes E6010, E6011, E6013, E7018 and E7024
e. Various gages of mild steel plate

CLASSROOM HOURS

70

EVALUATION ARC-6 (continued)

a. Given an AC/DC shielded arc welding machine, related apparatus and tools, the student will weld T-fillet joints in the flat, horizontal, vertical and overhead positions using various gages of mild steel plate and a variety of different electrodes. All welds will exhibit the characteristics of a good weld and will be free of errors.

b. V'TECS, Performance Guide, Task 17

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

c. Selection of electrodes
d. Low hydrogen electrodes
e. Bead type and distribution
f. Welding in different positions
g. Errors and their causes

TASK

ARC-7 Testing arc welded joints

PERFORMANCE OBJECTIVE

Test arc welded joints using the break test and the guided bend test.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Conducting the break test
b. Characteristics of a good break
   (1) Face smooth and regular
   (2) Complete fusion, full penetration
   (3) No undercutting
   (4) No slag or gas pockets in weld
c. Conducting the guided bend test
   (1) Face bend
   (2) Root bend
d. Characteristics of a good bend
   (1) No cracks or breaks
   (2) Complete fusion

(Continued on back)

Provide Demonstration On:

a. Conducting joint tests
b. Examples of good welds

Provide Practical Application On:

a. Conducting break and bend tests
b. Conducting sawed cross-section test
c. Conducting chisel test

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Griffin, Basic Arc Welding
c. Althouse
d. Oregon
e. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase B, Unit B-40

Tools and Equipment:

a. Arc welded T-joints
b. Arc welded butt joints
c. Pliers, vice grips, bench vice
d. Hacksaw
e. Hammer, chisels, punch

CLASSROOM HOURS

10

EVALUATION ARC-7 (continued)

a. Given an AC/DC shielded arc welding machine, electrodes, metal plates and assorted tools, the student will weld several T-joints and V-groove butt joints and will test the joints using break tests, bend tests, saw tests and chisel tests.

b. V'TECS, Performance Guide, Task 29

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

e. Conducting a sawed cross-section test
f. Conducting a chisel test

TASK

TIG-1 Becoming acquainted with tungsten inert gas arc welding

PERFORMANCE OBJECTIVE

Demonstrate knowledge of tungsten inert gas arc welding applications, advantages and terminology.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Terminology
   1. Tig welding
   2. Tungsten electrode
   3. Inert gas shielding
   4. High frequency current
   5. Flow meter
   6. Collet
   7. Collet body or chuck
   8. Foot control
   9. Gas cup
   10. Porosity
   11. Thermal conductivity
   12. Metallurgy
   13. Aluminum oxide
   14. Alternating current
   15. Direct current straight polarity
   16. Direct current reverse polarity
   17. Filler rod
b. Application
c. Advantages

Provide Demonstration On:

TIG welding apparatus and its associated terminology

Provide Practical Application On:

Identifying TIG apparatus

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Althouse
c. Schell and Matlock
d. Oregon
e. Georgia, Welding, Instructor Guide
f. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-1), "Introduction to Tungsten Inert Gas Welding"

Student Manuals:

Georgia, Welding, Phase C, Unit C-1

Tools and Equipment:

TIG welding apparatus

CLASSROOM HOURS

7

EVALUATION TIG-1 (continued)

a. Given a list of the terms used in TIG welding, the student will correctly match the terms with their correct definition.

b. Written test items are available in Georgia, Welding, Instructor Guide, TIG welding test C-1.

TASK

TIG-2 Following safety procedures and regulations for TIG Welding

PERFORMANCE OBJECTIVE

Demonstrate knowledge of safety hazards, accident prevention, safety regulations and safety equipment.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Hazards
   1. Damage to eyes and skin from infrared and ultraviolet radiation
   2. Hot metals
   3. Toxic fumes and gases
   4. Shock
   5. Fire
   6. Explosions
b. Controlling Hazards
   1. Protective clothing
   2. Shop safety habits
   3. Proper ventilation
   4. Clean, neat work area
   5. Maintaining equipment

(continued on back)

Provide Demonstration On:

a. Safe and unsafe welding practices
b. Use of the fire extinguishers

Provide Practical Application On:

a. Handling fire extinguishers
b. First aid practices

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Althouse
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-2), "Safety Hazards in Welding"

Student Manuals:

Georgia, Welding, Phase C, Unit C-2

Tools and Equipment:

a. Welding apparatus
b. Protective clothing
c. First aid supplies
d. Fire extinguishers

CLASSROOM HOURS

4

EVALUATION TIG-2 (continued)

a. Given a list of typical TIG welding equipment and practices, the student will correctly identify sources of hazard, precautionary measures to be taken and correct handling of safety equipment.

b. Written test items are available in Georgia, Welding, Instructor Guide, TIG welding test C-2.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

6. Safety devices on equipment
7. Leak test

c. Classes of fires
d. Types and uses of fire extinguishers
   1. Pressurized water
   2. Soda-acid
   3. Carbon dioxide
   4. Dry chemical
   5. Foam
   6. Dry sand
e. Safety clothing
f. What to do in case of accident
   1. First aid
   2. Summoning aid

TASK

TIG-3 Identifying TIG welding equipment

PERFORMANCE OBJECTIVE

Identify all major parts of the equipment used in TIG welding.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Power supply controls
   1. Weld control switch
   2. Current selector
   3. Fine adjustment current control
   4. Polarity switch
   5. High frequency
   6. Gas and water connections
   7. Terminals
   8. Remote control
   9. Shielding gas afterflow timer
   10. Soft start

(continued on back)

Provide Demonstration On:

Use of the power supply controls

Provide Practical Application On:

Examining and identifying the parts of the TIG welding apparatus

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse
b. Giachino and Weeks
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-3), "TIG Welding Equipment"

Student Manuals:

Georgia, Welding, Phase C, Unit C-3

Tools and Equipment:

TIG welding apparatus

CLASSROOM HOURS

3

EVALUATION TIG-3 (continued)

a. Given the equipment used in TIG welding, the student will correctly identify the type and use of each piece of equipment and will identify each part of the equipment and its function.

b. Test items are available in Georgia, Welding, Instructor Guide, Volume II, TIG welding test C-3.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

b. Major parts of the TIG torch
   1. Cap
   2. Electrode
   3. Collet
   4. Collet holder
   5. Gas cup
c. Types of cups
   1. Ceramic
   2. Pyrex glass
   3. Metal
d. Types of shielding gas
   1. Argon
   2. Helium
   3. Argon-Helium mixes

TASK

TIG-4 Setting up TIG equipment to weld aluminum

PERFORMANCE OBJECTIVE

Set up TIG equipment to weld aluminum.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting up the power supply (See Evaluation section for steps)
b. Torch adjustments
   1. Types of electrodes
   2. Preparing the electrode
   3. Collet, Collet chuck and cup
   4. Electrode stick-out
c. Connecting ground clamp
d. Aluminum metallurgy
e. Aluminum filler rods
f. Cleaning the metal

Provide Demonstration On:

a. Setting up and adjusting TIG equipment for aluminum
b. Preparing electrodes
c. Types of filler rods

Provide Practical Application On:

a. Setting up and adjusting TIG equipment for welding aluminum
b. Preparing electrodes
c. Leak testing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse
b. Giachino and Weeks
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-4), "Setting up TIG Equipment to Weld Aluminum"

Student Manuals:

Georgia, Welding, Phase C, Unit C-4

Tools and Equipment:

a. TIG welding equipment
b. Argon
c. Pure or zirconiated tungsten electrodes
d. Filler rods

CLASSROOM HOURS

7

EVALUATION TIG-4 (continued)

Have student set up and adjust TIG equipment according to the following checklist.

	STEPS	S	U
1.	Set current range selector	( )	( )
2.	Fine adjust current	( )	( )
3.	Set polarity switch to AC	( )	( )
4.	Set weld control switch to TIG	( )	( )
5.	Set frequency control	( )	( )
6.	Switch power on	( )	( )
7.	Mount flowmeter to argon cylinder	( )	( )
8.	Leak test	( )	( )
9.	Adjust shielding gas flow rate	( )	( )
10.	Adjust post purge timer	( )	( )
11.	Set soft start to "on"	( )	( )
12.	Set foot control switch to remote	( )	( )
13.	Select electrode	( )	( )
14.	Prepare electrode with shiny balled end	( )	( )
15.	Select collet, chuck, cup	( )	( )
16.	Adjust electrode stick-out	( )	( )
17.	Connect ground clamp	( )	( )

TASK

TIG-5 TIG welding stringer beads on aluminum plate

PERFORMANCE OBJECTIVE

Strike an arc and weld stringer beads on aluminum plates in the flat, horizontal, vertical and overhead positions, with and without filler rods using TIG welding apparatus.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Striking an arc
   1. Polarity
   2. Current
   3. Gas flow
   4. Arc length
b. Torch position
   1. Angle
   2. Arc length
   3. Motion
   4. Speed
c. Using the filler rod
d. Forming beads
e. Errors and their causes

Provide Demonstration On:

a. Examples of proper and improper bead welds
b. Proper use of the filler rod and torch

Provide Practical Application On:

Welding stringer beads on aluminum plate in all four welding positions with and without filler rods

INSTRUCTIONAL MATERIALS

Textbooks:

a. Althouse
b. Giachino and Weeks
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-5), "Striking an Arc and Welding Stringer Beads"

Student Manuals:

Georgia, Welding, Phase C, Units C-5 and C-6

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Argon gas
d. Assorted tools
e. Carbon or copper plate
f. 1/8" aluminum plate
g. Filler rods

CLASSROOM HOURS

20

EVALUATION TIG-5 (continued)

Given TIG welding equipment and related apparatus, the student will set up the equipment and weld a series of stringer beads on aluminum plate in each of the four welding positions. Beads must be of correct form and free of errors.

TASK

TIG-6 TIG welding lap joints using aluminum plate

PERFORMANCE OBJECTIVE

TIG weld lap joints in the flat, horizontal, vertical and overhead positions using aluminum plate of various gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of lap joints
b. Edge preparation
c. Positioning of metals
d. Leg dimensions
e. Selecting the electrode
f. Setting up the equipment
g. Selecting the filler rod
h. Welding method for the four positions
    1. Tacking
    2. Bead form and sequence
    3. Torch angle
    4. Motion of torch
    5. Direction of torch travel
    6. Arc length

(continued on back)

Provide Demonstration On:

a. Examples of good and bad lap joint welds
b. Proper welding technique

Provide Practical Application On:

Welding lap joints in the four positions using various gages of aluminum plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Althouse
c. Oregon
d. Schell and Matlock
e. Georgia, Welding Instructor Guide
f. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-9), "Welding Lap Joints on Aluminum in Vertical Position"

Student Manuals:

Georgia, Welding, Phase C, Units C-7 and C-9

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Aluminum plate 1/16" to 1/4"
e. Filler rods
f. Argon gas

CLASSROOM HOURS

20

EVALUATION TIG-6 (continued)

a. The student will TIG weld lap joints in the flat, horizontal, vertical and overhead positions using various gages of aluminum plate. Welds will be break tested and will be free of errors and faults.

b. V'TECS, Performance Guide, Task 24

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

7. Position and motion of filler rod
8. Amperage
9. Gas flow

i. Errors and their causes
j. Testing joints
k. Characteristics of a good weld
l. Welding with various gages of aluminum plate

TASK

TIG-7 TIG welding butt joints using aluminum plate

PERFORMANCE OBJECTIVE

TIG weld butt joints in the flat, horizontal, vertical and overhead position using aluminum plate of various gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of butt joints
   1. Square butt
   2. Square groove
   3. Single and double V groove
   4. Single and double bevel groove
   5. Single and double U groove
   6. Single and double J groove
b. Edge preparation
c. Root opening
d. Bead form and sequence
e. Back up bar
f. Welding different gage metals

(continued on back)

Provide Demonstration On:

a. Different types of butt joints
b. Examples of good and bad welds
c. Bend testing welds
d. Proper welding techniques

Provide Practical Application On:

a. Welding butt joints in the four positions using aluminum plate of various gages
b. Bend testing joints

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase C, Units C-8 and C-10

Tools and Equipment:

a. TIG welding equipment
b. Protective clothing
c. Assorted tools
d. Aluminum plate, 1/16" to 1/4"
e. Aluminum filler rods

CLASSROOM HOURS

35

EVALUATION TIG-7 (continued)

a. Using TIG welding apparatus the student will weld a square butt, a bevel groove, a V groove, a U groove and a J groove butt joint using aluminum plate of various gages. At least one joint will be welded in each of the four positions. Joints will be bend tested and will be free of errors.

b. V'TECS, Performance Guide, Task 57

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Welding in different positions
    1. Flat
    2. Horizontal
    3. Vertical
    4. Overhead
h. Welding techniques
    1. Motion of torch
    2. Electrode angle
    3. Direction of travel
    4. Arc length
    5. Filler rod motion
    6. Filler rod angle
    7. Single pass and multiple pass welds
i. Errors and their causes
j. Using different filler rods
k. Testing weld joints
l. Characteristics of good welds
m. Welding with various gages of aluminum plate

TASK

TIG-8 TIG welding fillet joints using aluminum plate

PERFORMANCE OBJECTIVE

TIG weld fillet joints in the flat, horizontal, vertical and overhead positions using aluminum plate of various gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of fillet joints
b. Uses of fillet joints
c. Edge preparation
d. Positioning of metals
e. Selecting the electrode
f. Setting up the equipment
g. Selecting the filler rod
h. Welding method for the four positions
    1. Tacking
    2. Bead form and sequence
    3. Torch angle and motion
    4. Arc length
    5. Position and motion of filler rod
    6. Amperage
    7. Gas flow

(continued on back)

Provide Demonstration On:

a. Different types of fillet joints
b. Examples of good and bad welds
c. Proper welding technique

Provide Practical Application On:

Welding fillet joints in the four positions using aluminum plate of various gages

INSTRUCTIONAL MATERIALS

Textbooks:

a. Georgia, Welding, Instructor Guide
b. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase C, Unit C-11

Tools and Equipment:

a. TIG welding equipment
b. Protective clothing
c. Assorted tools
d. Aluminum plate, 1/16" to 1/4"
e. Aluminum filler rods

CLASSROOM HOURS

35

EVALUATION TIG-8 (continued)

a. The student will TIG weld fillet joints in the flat, horizontal, vertical and overhead positions using various gages of aluminum plate. Welds will be break tested and will be free of errors and faults.

b. V'TECS, Performance Guide, Task 56

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

i. Errors and their causes
j. Testing joints
k. Characteristics of a good fillet weld
l. Welding with various gages of aluminum plate

TASK

TIG-9 Welding corner joints using aluminum plate

PERFORMANCE OBJECTIVE

TIG weld corner joints in the flat, horizontal, vertical and overhead positions using aluminum plate of various gages.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of corner joints
b. Edge preparation
c. Positioning of metals
d. Selecting the electrode
e. Setting up the equipment
f. Selecting the filler rod
g. Welding method for the four positions
   1. Tacking
   2. Bead form and sequence
   3. Torch angle and motion
   4. Arc length
   5. Position and motion of filler rod
   6. Amperage
   7. Gas flow

(continued on back)

Provide Demonstration On:

a. Examples of good and bad corner joint welds
b. Proper welding technique

Provide Practical Application On:

Welding both inside and outside corner joints in all four welding positions using aluminum plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Griffin, Basic TIG & MIG Welding

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Argon gas
d. Aluminum plate, various gages
e. Aluminum filler rods
f. Assorted tools

CLASSROOM HOURS

21

EVALUATION TIG-9 (continued)

The student will TIG weld inside and outside corner joints in the flat, horizontal, vertical and overhead positions using various gages of aluminum plate. Welds will be tested and will be free of errors and faults.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

h. Errors and their causes
i. Testing weld joints
j. Characteristics of good welds
k. Welding with various gages of aluminum plate

TASK

TIG-10 Setting up TIG equipment to weld stainless steel and mild steel

PERFORMANCE OBJECTIVE

Set up TIG equipment to weld various types of stainless steel and mild steel.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of stainless steel and their characteristics
   1. Iron and chromium
   2. Nickel addition
   3. Molybdenum addition
   4. Straight chromium
   5. Chromium and nickel
b. Welding metallurgy for stainless
   1. Thermal conductivity
   2. Distortion
c. Stainless steel filler rods
d. Setting up the power supply

(continued on back)

Provide Demonstration On:

a. Setting up and adjusting TIG equipment for stainless steel and mild steel
b. Preparing electrodes
c. Types of filler rods

Provide Practical Application On:

a. Setting up and adjusting TIG equipment for welding stainless steel and mild steel
b. Preparing electrodes
c. Leak testing

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (C-12), "Setting up TIG Equipment to Weld Stainless Steel and Mild Steel"

Student Manuals:

Georgia, Welding, Phase C, Unit C-12

Tools and Equipment:

a. TIG welding apparatus
b. Argon gas
c. Stainless steel filler rods
d. Mild steel filler rods
e. Protective clothing

(continued on back)

CLASSROOM HOURS

7

EVALUATION TIG-10 (continued)

Have the student set up and adjust TIG equipment according to the following checklist.

	STEPS	S	U
1.	Set current range selector	( )	( )
2.	Fine adjust current	( )	( )
3.	Set polarity switch to DC or DCSP	( )	( )
4.	Set weld control switch to TIG	( )	( )
5.	Set frequency control	( )	( )
6.	Switch power to "on"	( )	( )
7.	Mount flowmeter to argon cylinder	( )	( )
8.	Leak test	( )	( )
9.	Adjust shielding gas flow	( )	( )
10.	Adjust post purge time	( )	( )
11.	Set soft start to "on"	( )	( )
12.	Set foot control switch	( )	( )
13.	Select electrode	( )	( )
14.	Prepare electrode end	( )	( )
15.	Select collet, collet chuck	( )	( )
16.	Adjust electrode stick out	( )	( )
17.	Connect ground clamp	( )	( )

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

e. Torch adjustments
   1. Types of electrodes
   2. Preparing the electrode
   3. Collet, collet chuck and cup
   4. Electrode stick out
f. Connecting ground clamp
g. Cleaning the metals

INSTRUCTIONAL MATERIALS (continued)

Tools and Equipment:

f. Assorted tools
g. Stainless steel plate, various types
h. Mild steel plate, several gages

TASK

TIG-11 TIG welding stringer beads on stainless steel and mild steel

PERFORMANCE OBJECTIVE

TIG weld stringer beads on stainless steel and mild steel plates in the flat, horizontal, vertical and overhead positions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Striking an arc
   1. Polarity
   2. Current
   3. Gas flow
   4. Arc length
b. Torch position and motion
c. Selecting a filler rod
d. Position and motion of filler rod
e. Bead form and sequence
f. Errors and their causes

Provide Demonstration On:

a. Examples of proper and improper bead welds
b. Proper use of the torch and filler rod

Provide Practical Application On:

a. Welding stringer beads on stainless steel plate in all four welding positions
b. Welding stringer beads on mild steel plate in all four welding positions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase C, Unit C-13

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Stainless steel plate, various types
e. Stainless steel filler rod
f. Mild steel plate, various gages
g. Mild steel filler rods

CLASSROOM HOURS

20

EVALUATION TIG-11 (continued)

The student will TIG weld a series of stringer beads on stainless steel plate and on mild steel plate in the flat, horizontal, vertical and overhead positions. Beads must be of correct form and free of errors.

TASK

TIG-12 TIG welding lap joints using stainless steel and mild steel plate

PERFORMANCE OBJECTIVE

TIG weld lap joints in the flat, horizontal, vertical and overhead positions using stainless steel and mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of lap joints
b. Edge preparation
c. Positioning of metals
d. Selecting the electrode
e. Setting up the equipment
f. Selecting the filler rod
g. Welding method for the four positions
    1. Tacking
    2. Bead form and sequence
    3. Torch angle and motion
    4. Arc length
    5. Position and motion of filler rod
    6. Amperage
    7. Gas flow

(continued on back)

Provide Demonstration On:

a. Examples of good and bad lap joint welds
b. Proper welding technique

Provide Practical Application On:

Welding lap joints in the four positions using various gages of stainless and mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase C, Units C-16 and C-17

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Argon gas
e. Stainless steel plate, various types
f. Stainless steel filler rods
g. Mild steel plate, various gages
h. Mild steel filler rods

CLASSROOM HOURS

20

EVALUATION TIG-12 (continued)

The student will TIG weld lap joints in the flat, horizontal, vertical and overhead positions using various types of stainless steel plate and various gages of mild steel plate. Welds will be break tested and will be free of errors and faults.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

h. Errors and their causes
i. Testing weld joints
j. Characteristics of good welds
k. Welding with various gages of metal
l. Welding with various types of stainless steel

TASK

TIG-13 TIG welding butt joints using stainless steel and mild steel plate

PERFORMANCE OBJECTIVE

TIG weld butt joints in the flat, horizontal, vertical and overhead positions using stainless steel and mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of butt joints
   1. Square butt
   2. Square groove
   3. Single and double V groove
   4. Single and double bevel groove
   5. Single and double U groove
   6. Single and double J groove
b. Edge preparation
c. Root opening
d. Back up bar
e. Positioning the metals
f. Selecting the electrode

(continued on back)

Provide Demonstration On:

a. Different types of butt joints
b. Examples of good and bad butt welds
c. Bend testing welds
d. Proper welding technique

Provide Practical Application On:

a. Welding butt joints in the four positions using various types of stainless steel and various gages of mild steel
b. Bend testing butt joints

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase C, Unit C-18

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Argon gas
e. Stainless steel plate, various types
f. Stainless steel filler rods
g. Mild steel plate, various gages
h. Mild steel filler rods

CLASSROOM HOURS

35

EVALUATION TIG-13 (continued)

Using TIG welding apparatus the student will weld a square butt, a V groove, a U groove, a bevel groove, and a J groove butt joint using various types of stainless steel and various gages of mild steel. At least one joint will be welded in each of the four positions. Joints will be free of errors and flaws.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Setting up the equipment
h. Selecting the filler rod
i. Welding method for the four positions
    1. Tacking
    2. Bead form and sequence
    3. Torch angle and motion
    4. Arc length
    5. Position and motion of filler rod
    6. Amperage
    7. Gas flow
    8. Single pass and multiple pass welds
j. Errors and their causes
k. Testing weld joints
l. Characteristics of good butt welds
m. Welding with various gages of metal
n. Welding with different types of stainless steel

TASK

TIG-14 TIG welding fillet joints using stainless steel and mild steel plate

PERFORMANCE OBJECTIVE

TIG weld fillet joints in the flat, horizontal, vertical and overhead positions using various types of stainless steel and various gages of mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of fillet joints
b. Edge preparation
c. Positioning of metals
d. Selecting the electrode
e. Setting up the equipment
f. Selecting the filler rod
g. Welding method for the four positions
    1. Tacking
    2. Bead form and sequence
    3. Arc length
    4. Torch angle and motion
    5. Position and motion of filler rod
    6. Amperage
    7. Gas flow

(continued on back)

Provide Demonstration On:

a. Different types of fillet joint welds
b. Examples of good and bad fillet welds
c. Proper welding technique

Provide Practical Application On:

a. Welding fillet joints in the four positions using various types and gages of stainless steel
b. Welding fillet joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase C, Unit 14

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Argon gas
e. Stainless steel plate, various types
f. Stainless steel filler rods
g. Mild steel plate, various gages
h. Mild steel filler rods

CLASSROOM HOURS

35

EVALUATION TIG-14 (continued)

The student will TIG weld fillet joints in the flat, horizontal, vertical and overhead positions using various types and gages of stainless steel plate and various gages of mild steel plate. Welds will be free of errors and flaws.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

8. Single and multiple pass welds
h. Errors and their causes
i. Testing fillet joints
j. Characteristics of good fillet welds
k. Welding with various gages of metal
l. Welding with various types of stainless steel

TASK

TIG-15 TIG welding corner joints using stainless steel and mild steel plate

PERFORMANCE OBJECTIVE

TIG weld inside and outside corner joints in the flat, horizontal, vertical and overhead positions using stainless steel and mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of corner joints
   1. Inside joint
   2. Outside joint
b. Edge preparation
c. Positioning of metals
d. Selecting the electrode
e. Setting up the equipment
f. Selecting the filler rod
g. Welding method for the four positions
   1. Tacking
   2. Bead form and sequence
   3. Arc length
   4. Torch angle and motion
   5. Position and motion of filler rod
   6. Amperage

(continued on back)

Provide Demonstration On:

a. Different types of corner joint welds
b. Examples of good and bad corner joint welds
c. Proper welding technique

Provide Practical Application On:

a. Welding corner joints in the four positions using various types and gages of stainless steel plate
b. Welding corner joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Schell and Matlock
b. Georgia, Welding, Instructor Guide

Student Manuals:

Georgia, Welding, Phase C, Unit 15

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Argon gas
e. Stainless steel plate, various types
f. Stainless steel filler rods
g. Mild steel plate, various gages
h. Mild steel filler rods

CLASSROOM HOURS

21

EVALUATION TIG-15 (continued)

The student will TIG weld inside and outside corner joints in the flat, horizontal, vertical and overhead positions using various types and gages of stainless steel and various gages of mild steel plate. Welds will be free of errors and flaws.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

7. Gas flow

h. Errors and their causes
i. Testing corner joints
j. Characteristics of good corner joint welds
k. Welding with various gages of metal
l. Welding with various types of stainless steel

TASK

TIG-16 TIG welding pipe joints

PERFORMANCE OBJECTIVE

TIG weld pipe joints in a fixed position using mild steel pipe.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Cutting pipe
b. Preparing ends
c. Positioning of metals
d. Selecting the electrode
e. Setting up the equipment
f. Selecting the filler rod
g. Welding method
    1. Tacking
    2. Bead form and sequence
    3. Arc length
    4. Torch angle and motion
    5. Position and motion of filler rod
    6. Amperage
    7. Gas flow

(continued on back)

Provide Demonstration On:

a. Examples of good and bad pipe joint welds
b. Proper welding technique

Provide Practical Application On:

Welding pipe joints using various diameters of pipe and various gages of mild steel pipe

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide

A/Vs:

Georgia, Slide/Tape (C-19), "Welding Pipe Joints in the Fixed Position"

Student Manuals:

Georgia, Welding, Phase C, Unit C-19

Tools and Equipment:

a. TIG welding apparatus
b. Protective clothing
c. Assorted tools
d. Argon gas
e. Mild steel pipe, various gages and diameters

CLASSROOM HOURS

30

EVALUATION TIG-16 (continued)

The student will TIG weld pipe joints using various types of joints and various gages of mild steel. Welds will be free of errors and flaws.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

h. Errors and their causes
i. Characteristics of a good pipe joint weld
j. Welding with various gages of metal

TASK

MIG-1 Becoming acquainted with MIG welding

PERFORMANCE OBJECTIVE

The student will demonstrate a knowledge of the MIG welding process and of safety hazards and precautions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. MIG welding applications and advantages
b. Major equipment components and functions
    1. Power supply
    2. Wire feed control
    3. Shielding gas source
    4. Welding gun
c. MIG terminology
d. Safety hazards
    1. Electric shock
    2. Radiation burns to eyes
    3. Sources of fire
    4. Danger of explosions
    5. Toxic fumes

(continued on back)

Provide Demonstration On:

a. MIG welding equipment and its terminology
b. Proper handling of equipment

Provide Practical Application On:

a. Use of fire extinguishers
b. Giving first aid for simulated welding accidents

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Sacks
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

A/Vs:

a. Georgia, Slide/Tape (D-1), "Introduction to Inert Gas Welding"
b. Georgia, Slide/Tape (D-2), "Gas Metal Arc Welding Safety"
c. Georgia, Slide/Tape (D-3), "Identification of Gas Metal Arc Welding Machines"

Student Manuals:

Georgia, Welding, Phase D, Units D-1, D-2 and D-3

Tools and Equipment:

a. MIG welding equipment
b. Protective clothing
c. Fire extinguishers

CLASSROOM HOURS

10

EVALUATION MIG-1 (continued)

a. The student will accurately match the MIG welding terminology with the MIG welding apparatus and procedures and will identify the sources of hazard associated with MIG welding and the proper precautions or remedies to be taken.

b. Georgia, Welding, Instructor Guide, Volume IV

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

6. Welding containers that have held combustibles
e. Protective clothing
f. Types and uses of fire extinguishers
g. First aid
d. Good shop practices

TASK

MIG-2 MIG welding beads on mild steel plate

PERFORMANCE OBJECTIVE

MIG weld beads on mild steel plate of various gages in the flat, horizontal, vertical and overhead positions.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Setting up the equipment
b. Selecting the electrode
c. Adjusting the contact tip and gas shield
d. Adjusting wire stick out
e. Setting gas flow
f. Setting wire speed
g. Setting voltage
h. Welding gun movements
    1. Pull
    2. Push
    3. Whip and pause
    4. Straight drag
    5. Semicircular
    6. Circular
    7. Straight weave

(continued on back)

Provide Demonstration On:

a. Examples of good and bad bead welds
b. Welding errors and their causes
c. Proper welding technique

Provide Practical Application On:

a. Using the different welding techniques
b. Welding beads on plates of various gages in the four welding positions

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (D-4), "Setting up Machine and Running Beads"

Student Manuals:

Georgia, Welding, Phase D, Unit D-4

Tools and Equipment:

a. MIG welding equipment
b. CO_2 shielding gas
c. Protective clothing
d. Mild steel electrode wire
e. Mild steel plate, various gages

CLASSROOM HOURS

24

EVALUATION MIG-2 (continued)

The student will MIG weld beads on mild steel plate of various gages. Welds will be made in the flat, horizontal, vertical and overhead positions using the push, pull, whip and pause, straight drag, semicircular, circular and straight weave motions. All welds will be free of errors and flaws.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

i. Characteristics of a good bead weld
j. Errors and their causes
    1. Cold lapping
    2. Excessive prentration
    3. Burn-through
    4. Surface porosity
    5. Poor appearance
    6. Whiskers
    7. Bad tie-in
    8. Suck back

TASK

MIG-3 MIG welding butt joints using mild steel

PERFORMANCE OBJECTIVE

MIG weld butt joints in the flat, horizontal, vertical and overhead positions using mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of butt joints
   1. Square butt
   2. Square groove
   3. Single and double V groove
   4. Single and double bevel groove
   5. Single and double U groove
   6. Single and double J groove
b. Edge preparation
c. Root opening
d. Keyhole
e. Bead form and sequence
f. Back up bar

(continued on back)

Provide Demonstration On:

a. Different types of butt joints
b. Examples of good and bad butt welds
c. Proper welding technique
d. Bend testing welds

Provide Practical Application On:

a. Welding butt joints in the four positions using various gages of mild steel plate
b. Testing joints

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

A/Vs:

a. Georgia, Slide/Tape (D-5), "Weld a Butt Joint in the Flat Position"
b. Georgia, Slide/Tape (D-9), "Weld a Butt Joint in the Vertical Position"

Student Manuals:

Georgia, Welding, Phase D, Units D-5, D-8, D-9, D-12, D-15, D-16

Tools and Equipment:

a. MIG welding equipment
b. Protective clothing
c. CO_2 shielding gas
d. Mild steel electrode wire
e. Mild steel plate, various gages

CLASSROOM HOURS

35

EVALUATION MIG-3 (continued)

a. The student will MIG weld a square butt, a bevel groove, a V groove, a U groove and a J groove butt joint using various gages of mild steel plate. At least one weld will be in each of the four positions. Joints will be bend tested and will be free of errors and flaws.

b. V'TECS, Performance Guide, Tasks 18, 21, 22 and 23

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Welding different gage metals
h. Welding technique
    1. Tacking
    2. Torch angle and motion
    3. Arc length
    4. Gas flow
    5. Wire speed
    6. Voltage
i. Characteristics of good butt welds
j. Single pass and multiple pass welds
k. Errors and their causes

TASK

MIG-4 MIG welding lap joints using mild steel plate

PERFORMANCE OBJECTIVE

MIG weld lap joints in the flat, horizontal, vertical and overhead positions using mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Edge preparation
b. Selecting the electrode wire
c. Setting up the equipment
d. Adjusting gas flow, voltage and wire speed
e. Tacking
f. Gun motion and speed
g. Bead form and sequence
h. Welding different gage metals
i. Characteristics of good lap welds
j. Errors and their causes

Provide Demonstration On:

a. Examples of good and bad lap joint welds
b. Errors and their causes
c. Proper welding technique

Provide Practical Application On:

a. Welding lap joints in the four positions using various gage metals
b. Testing joints

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

A/Vs:

Georgia, Slide/Tape (D-6), "Weld a Lap Joint in the Horizontal Position"

Student Manuals:

Georgia, Welding, Phase D, Unit D-6

Tools and Equipment:

a. MIG welding equipment
b. CO_2 shielding gas
c. Assorted tools
d. Mild steel electrode wire
e. Mild steel plate, various gages
f. Protective clothing

CLASSROOM HOURS

20

EVALUATION MIG-4 (continued)

a. The student will MIG weld lap joints in the flat, horizontal, vertical and overhead positions using various gages of mild steel plate. Welds will be bend tested and will be free of flaws and errors.

b. V'TECS, Performance Guide, Task 24

TASK

MIG-5 MIG welding fillet joints using mild steel plate

PERFORMANCE OBJECTIVE

MIG weld fillet joints in the flat, horizontal, vertical and overhead positions using mild steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of fillet joints
b. Edge preparation
c. Positioning of metals
d. Selecting the electrode wire
e. Setting up the equipment
f. Weld method for the four positions
   1. Tacking
   2. Bead form and sequence
   3. Gun angle and motion
   4. Gas flow, voltage, amperage
g. Welding with various gage metals
h. Characteristics of good fillet welds
i. Errors and their causes

Provide Demonstration On:

a. Different types of fillet joints
b. Examples of good and bad welds
c. Proper welding technique

Provide Practical Application On:

Welding fillet joints in the four positions using various gages of mild steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Schell and Matlock
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase D, Units D-7, D-10, D-11, D-13 and D-14

Tools and Equipment:

a. MIG welding equipment
b. CO_2 shielding gas
c. Protective clothing
d. Assorted tools
e. Mild steel plate, various gages
f. Mild steel electrode wire

CLASSROOM HOURS

35

EVALUATION MIG-5 (continued)

a. The student will MIG weld fillet joints in the flat, horizontal, vertical and overhead positions using mild steel plate of various gages. Welds will be tested and will be free of flaws and errors.

b. V'TECS, Performance Guide, Task 17

TASK MIG-6 MIG welding with stainless steel

PERFORMANCE OBJECTIVE

MIG weld lap joints, butt joints, fillet joints and corner joints using various types and gages of stainless steel plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of stainless steel and their characteristics
   1. Iron and chromium
   2. Nickel addition
   3. Molybdenum addition
   4. Straight chromium
   5. Chromium and nickel
b. Welding metallurgy for stainless steel
   1. Thermal conductivity
   2. Distortion
c. Advantages of MIG welding
d. Selecting the electrode wire
e. Selecting shielding gas
f. Setting gas flow, voltage and amperage

(continued on back)

Provide Demonstration On:

a. Identifying types of stainless steel
b. Proper welding technique
c. Examples of errors and their causes

Provide Practical Application On:

a. Identifying types of stainless steel
b. Welding all types of joints in different welding positions using various types and gages of stainless steel plate

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Sacks
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase D, Units D-17 and D-18

Tools and Equipment:

a. MIG welding equipment
b. Helium + Argon + CO_2 shielding gas
c. ER308 wire electrode
d. Protective clothing
e. Assorted tools
f. Stainless steel plate, various types and gages

CLASSROOM HOURS

80

EVALUATION MIG-6 (continued)

a. The student will MIG weld a variety of different joints in the four welding positions using various types and gages of stainless steel plate. All welds will be free of flaws and errors.

b. V'TECS, Performance Guide, Task 58

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

g. Arc length
h. Back up gas shield
i. Copper back up strip
j. Welding technique with stainless steel
k. Welding errors and their causes

TASK

MIG-7 MIG welding with aluminum

PERFORMANCE OBJECTIVE

MIG weld lap joints, butt joints, fillet joints and corner joints using various types and gages of aluminum and aluminum alloy plate.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Types of aluminum and aluminum alloys
   1. Straight aluminum
   2. Aluminum-copper
   3. Aluminum-magnesium
   4. Aluminum-manganese
   5. Aluminum-silicon
   6. Aluminum-zinc
b. Welding metallurgy for aluminum
c. Joint preparation
d. Cleaning the metals
e. Electrode wire selection
f. Shielding gas selection
g. Back up shielding

(continued on back)

Provide Demonstration On:

a. Identifying aluminum and aluminum alloys
b. Proper welding technique
c. Examples of errors and their causes

Provide Practical Application On:

a. Identifying aluminum and aluminum alloy metals
b. Welding all types of joints in different positions using various gages of aluminum and aluminum alloys

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Sacks
c. Schell and Matlock
d. Georgia, Welding, Instructor Guide
e. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase D, Units D-19 and D-20

Tools and Equipment:

a. MIG welding equipment
b. Argon shielding gas
c. ER4043 and ER1100 electrode wire
d. Protective clothing
e. Assorted tools
f. Aluminum and aluminum alloy plates of various gages

CLASSROOM HOURS

80

EVALUATION MIG-7 (continued)

The student will MIG weld a variety of different joints in the four welding positions using aluminum and aluminum alloys of various gages. All welds will be free of flaws and errors.

INSTRUCTIONAL ACTIVITIES (continued)

Provide Information On:

h. Setting gas flow, voltage and amperage
i. Arc length
j. Welding technique for various joints, positions, gages and types of metals

TASK

MIG-8 Flux-cored arc welding (FCAW)

PERFORMANCE OBJECTIVE

MIG weld joints using flux-cored steel wire and mild steel plates.

INSTRUCTIONAL ACTIVITIES

Provide Information On:

a. Uses of FCAW
b. Types of flux-cored wire
   1. Gas shielded
   2. Self-shielded
c. Advantages of FCAW
d. Electrode wire selection
e. Shielding gas selection
f. Joint preparation
g. Voltage, current and gas flow
h. Wire stick out
i. Arc length
j Gun angle and motion
k. Single and multiple pass welds
l. Ventilation

Provide Demonstration On:

a. Use of the machine adjustment chart
b. Use of the electrode selection chart
c. Proper welding technique

Provide Practical Application On:

a. Welding various joints in the four welding positions using flux-cored steel wire and mild steel plate
b. Welding with both gas shielded and self-shielded flux-cored electrode wire

INSTRUCTIONAL MATERIALS

Textbooks:

a. Giachino and Weeks
b. Sacks
c. Georgia, Welding, Instructor Guide
d. Griffin, Basic TIG & MIG Welding

Student Manuals:

Georgia, Welding, Phase D, Units D-21 and D-22

Tools and Equipment:

a. MIG welding equipment
b. CO_2 shielding gas
c. Flux-cored electrode wire
d. Protective clothing
e. Assorted tools
f. Mild steel plate, various gages

CLASSROOM HOURS

30

EVALUATION (MIG-8)

The student will use flux-cored steel wire to MIG weld lap joints, butt joints, fillet joints and corner joints using various gages of mild steel plate.

SECTION VI

REFERENCES, RESOURCES

DO NOT FILM THIS PAGE

RESOURCES

Instructional Resource Matrix

The Instructional Resource Matrix lists the instructional resources required to carry out the learning activities in each unit in the program. The resources are divided into the categories of audio visuals, textbooks and student materials.

Audio visuals are identified by the following symbols: slide/tapes (ST), video-cassette tapes (VC) and transparencies (TR).

Textbooks are identified by the author(s)/publisher and title.

Textbook List

This list identifies the textbooks referenced in the Unit Guide section and on the Instructional Resource Matrix.

Audio Visuals

The suppliers of the audio visuals referenced on the Unit Guides and the Instructional Resource Matrix are listed.

Additional Instructional Resources

This section lists instructional resources which may be used in addition to those primary resources listed on the Unit Guides. The resources are divided into two categories.

Resource Addresses

Addresses of instructional materials referenced on the Unit Guides and in the Additional Instructional Resources section are given.

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
WLD-1	Orientation to the welding program	Georgia: A-01, "Operating the Singer Caramate, (ST); Georgia: A-03, "Introduction to Individualized Instruction," (ST): Georgia: A-04, "General Shop Safety." (ST)	Georgia: Welding, Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Welding Processes; Oregon: Welding.	Georgia: Welding, Phase A, Unit 1
WLD-2	Identifying and using welding symbols		Griffin: Welding Processes; Schell: Industrial Welding Procedures.	
WLD-3	Using welding related shop tools		Griffin: Welding Processes; Schell, Industrial Welding Procedures.	
WLD-4	Identifying and preparing metals for welding	Georgia: A-7, "Metallurgy"	Georgia: Welding, Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Welding Processes; Oregon: Welding.	Georgia: Welding, Phase A, Unit 7

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
WLD-5	Measuring welding materials		Georgia: Welding, Instructor Guide; Oregon: Welding.	Georgia: Welding, Phase A, Unit A-7A
WLD-6	Using clamps and jigs		Griffin: Basic TIG and MIG Welding.	
WLD-7	Reading Blueprints		Bennett: Blueprint Reading for Welders.	
OXA-1	Following safety procedures and regulations for oxyacetylene welding	Georgia: A-5A, "Safety." (ST); Georgia: A-5B, "Safety" (ST).	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse, Modern Welding.	Georgia: Welding, Phase A, Unit 5

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-2	Using oxyacetylene cylinders and gases	Georgia: A-2, "Cylinders and Gases." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia: Welding, Phase A Unit 2
OXA-3	Inspecting oxygen and acetylene regulators	Georgia: A-3, "Regulators" (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia: Welding, Phase A, Unit 3

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-4	Selecting and maintaining oxyacetylene torches and tips	Georgia: A-4, "Torches and Tips." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit 4
OXA-5	Setting up and lighting the oxyacetylene torch	Georgia: A-6, "Setting Up and Lighting The Torch"	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit 6

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-6	Carrying a puddle without a filler rod	Georgia: A-8, "Carrying a Puddle Without a Rod." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit 8
OXA-7	Welding an outside corner joint without a filler rod, using oxyacetylene equipment	Georgia: A-9, "Welding an Outside Corner Joint"	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia: Welding, Phase A, Unit 9

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-8	Making beads with filler rods, using oxyacetylene equipment		Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit 10
OXA-9	Welding butt joints using oxyacetylene equipment	Georgia: A-11, "Welding in a Flat Position." (ST) Georgia: A-12, "Vertical and Overhead Welding." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Units A-11 and A-12

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-10	Welding lap joints using oxyacetylene equipment		Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit 12
OXA-11	Welding T-joints using oxyacetylene equipment	Georgia: A-13, "Welding T-Joints." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-13

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-12	Setting up the oxy-acetylene apparatus for flame cutting	Georgia: A-14, "The Flame Cutting Process." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-14
OXA-13	Cutting with an oxy-acetylene cutting torch	Georgia: A-15, "Cutting a Straight Line." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-15

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-14	Piercing and cutting holes using the oxy-acetylene cutting torch	Georgia: A-16, "Cutting and Piercing Holes." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-16
OXA-15	Cutting with an automatic oxyacetylene cutting machine	Georgia: A-17, "Setting Up the Automatic Cutting Machine." (ST)	Georgia: Welding Instructor Guide; Althouse: Modern Welding; Cutting Machine Manual; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-17

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-16	Welding beads with brass rods using oxyacetylene welding equipment	Georgia: A-18, "Running Beads With A Brass Rod." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia: Welding, Phase A, Unit A-18
OXA-17	Brazing a lap joint using oxyacetylene apparatus		Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Griffin: Basic Oxyacetylene Welding; Althouse: Modern Welding; Oregon: Welding.	Georgia: Welding, Phase A, Unit A-19

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
OXA-18	Brazing with silver using oxyacetylene equipment		Oregon: Welding.	
OXA-19	Soldering	Georgia: A-20, "Silver Soldering Process." (ST)	Georgia: Welding Instructor Guide; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-20
OXA-20	Welding cast iron using oxyacetylene apparatus	Georgia: A-21, "Welding in Cast Iron." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Althouse: Modern Welding.	Georgia, Welding, Phase A, Unit A-21
OXA-21	Cutting and welding pipe using oxyacetylene apparatus	Georgia: A-22, "Pipe Welding." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding.	Georgia, Welding, Phase A, Unit A-22

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
ARC-1	Selecting and setting up shielded arc welding apparatus	Georgia: B-1, "Introduction to Shielded Arc Welding." (ST) Georgia: B-2, "Shielded Arc Welding Safety." (ST) Georgia: B-3, "Identification of Arc Welding Machines." (ST) Georgia: B-4, "Electrical Circuits." (ST) Georgia: B-6, "Setting Up Welding Machine and Striking an Arc." (ST) Georgia: B-9, "Identifying and Selecting Electrodes." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B Units B-1, B-2, B-3, B-4A, B-5, B-6 and B-9
ARC-2	Welding string and weave beads using shielded arc welding apparatus	Georgia: B-23, "Weld String and Weave Beads in the Overhead Position." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Oregon: Welding; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B, Units B-23, B-24, B-34, B-37

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
ARC-3	Arc welding string beads and padding a plate	Georgia: B-7, "Welding a Pad of Beads in the Flat Position." (ST)	Georgia: Welding Instructor Guide; Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B, Units B-7, B-12, B-16, B-18
ARC-4	Arc welding lap joints	Georgia: B-10, "Welding a Lap Joint in the Horizontal Position." (ST)	Georgia: Welding Instructor Guide; Althouse: Modern Welding; Oregon: Welding; Schell: Industrial Welding Procedures; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B, Units B-10, B-14, B-20, B-25 B-36, B-39

CURRICULUM AREA: Welding

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
ARC-5 Arc welding butt joints	Georgia: B-8, "Welding Butt Joints in the Flat Position." B-8	Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B, Units B-8, B-13, B-17, B-19, B-24, B-27, B-30, B-32, B-35, and B-38
ARC-6 Shield arc welding T-fillet joints		Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic Arc Welding.	Georgia, Welding, Phase B, Units B-11, B-15, B-21, B-22, B-26, B-31 and B-33

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
ARC-7	Testing arc welded joints		Giachino: Welding Skills and Practices; Griffin: Basic Arc Welding; Althouse: Modern Welding; Oregon: Welding; Georgia: Welding Instructor Guide.	Georgia, Welding, Phase B, Unit B-40
TIG-1	Orientation to tungsten inert gas arc welding	Georgia: C-1, "Introduction to Tungsten Inert Gas Welding." (ST)	Giachino: Welding Skills and Practices; Althouse: Modern Welding; Schell: Industrial Welding Procedures; Oregon: Welding; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Unit C-1

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-2	Following safety procedures and regulations for TIG welding	Georgia: C-2, "Safety Hazards in Welding." (ST)	Giachino: Welding Skills and Practices; Althouse: Modern Welding; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, C-2
TIG-3	Identifying TIG welding equipment	Georgia: C-3, "TIG Welding Equipment." (ST)	Althouse: Modern Welding; Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Unit C-3

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-4	Setting up TIG equipment to weld aluminum	Georgia: C-4, "Setting Up TIG Equipment to Weld Aluminum." (ST)	Althouse: Modern Welding; Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Unit C-4
TIG-5	TIG welding stringer beads on aluminum plate	Georgia: C-5, "Striking an Arc and Welding Stringer Beads." (ST)	Althouse: Modern Welding; Giachino: Welding Skills and Practices; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Units C-5 and C-6

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-6	TIG welding lap joints using aluminum plate	Georgia: C-9, "Welding Lap Joints on Aluminum in Vertical Position." (ST)	Giachino: Welding Skills and Practices; Althouse: Modern Welding; Oregon: Welding; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Units C-7 and C-9
TIG-7	TIG welding butt joints using aluminum plate		Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Units C-8 and C-10

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-8	TIG welding fillet joints using aluminum plate		Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Unit C-11
TIG-9	Welding corner joints using aluminum plate		Schell: Industrial Welding Procedures; Griffin: Basic TIG and MIG Welding.	
TIG-10	Setting up TIG equipment to weld stainless steel and mild steel	Georgia: C-12, "Setting Up TIG Equipment to Weld Stainless Steel and Mild Steel." (ST)	Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase C, Unit C-12

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-11	TIG welding stringer beads on stainless steel and mild steel		Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide.	Georgia, Welding, Phase C, Unit C-13
TIG-12	TIG welding lap joints using stainless steel and mild steel plate		Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide.	Georgia, Welding, Phase C, Units C-16 and C-17
TIG-13	TIG welding butt joints using stainless steel and mild steel plate		Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide.	Georgia, Welding, Phase C, Unit C-18

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
TIG-14	TIG welding fillet joints using stainless steel and mild steel plate		Schell: Industrial Welding Procedures; Georgia: Welding, Instructor Guide.	Georgia, Welding, Phase C, Unit 14
TIG-15	TIG welding corner joints using stainless steel and mild steel plate		Schell: Industrial Welding Procedures; Georgia: Welding, Instructor Guide.	Georgia, Welding, Phase C, Unit 15
TIG-16	TIG welding pipe joints	Georgia: C-19, "Welding Pipe Joints in the Fixed Position." (ST)	Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures.	Georgia, Welding, Phase C, Unit C-19

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MIG-1	MIG orientation and safety	Georgia: D-1, "Introduction to Inert Gas Welding." (ST) Georgia: D-2, "Gas Metal Arc Welding Safety." (ST) Georgia: D-3, "Identification of Gas Metal Arc Welding Machines." (ST)	Giachino: Welding Skills and Practices; Sacks: Welding: Principles and Practices; Schell: Industrial Welding Procedures Georgia: Welding Instructor Guide; Griffin Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-1, D-2, and D-3
MIG-2	MIG welding beads on mild steel plate	Georgia: D-4, "Setting Up Machine and Running Beads." (ST)	Giachino: Welding Skills and Practices; Schell, Industrial Welding Procedures Georgia: Welding Instructor Guide; Griffin Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Unit D-4

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MIG-3	MIG welding butt joints using mild steel	Georgia: D-5, "Weld a Butt Joint in the Flat Position." (ST) Georgia: D-9, "Weld a Butt Joint in the Vertical Position." (ST)	Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-5, D-8, D-9, D-12, D-15, D-16
MIG-4	MIG welding lap joints using mild steel plate	Georgia: D-6, "Weld a Lap Joint in the Horizontal Position." (ST)	Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Unit D-6

CURRICULUM AREA: Welding

TASK LISTING		INSTRUCTIONAL MATERIAL REFERENCES		
		Audio-Visuals	Textbooks	Student Materials
MIG-5	MIG welding fillet joints using mild steel plate		Giachino: Welding Skills and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-7, D-10, D-11, D-13, and D-14
MIG-6	MIG welding with stainless steel		Giachino: Welding Skills and Practices; Sacks: Welding Principles and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-17 and D-18

CURRICULUM AREA: Welding

TASK LISTING	INSTRUCTIONAL MATERIAL REFERENCES		
	Audio-Visuals	Textbooks	Student Materials
MIG-7 MIG welding with aluminum		Giachino: Welding Skills and Practices; Sacks: Welding Principles and Practices; Schell: Industrial Welding Procedures; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-19 and D-20
MIG-8 Flux-cored arc welding (FCAW)		Giachino: Welding Skills and Practices; Sacks: Welding Principles and Practices; Georgia: Welding Instructor Guide; Griffin: Basic TIG and MIG Welding.	Georgia, Welding, Phase D, Units D-21 and D-22

TEXTBOOK LIST

Althouse, Andrew D., Carl H. Turnquist, and William A. Bowditch, Modern Welding. South Holland, IL: Goodheart-Willcox, 1976.

Bennett, A. E., and Louis J. Siy, Blueprint Reading for Welders. Albany, NY: Delmar, 1978.

Georgia*, Welding, Instructor Guide, Vols. I and II. Atlanta, GA: Georgia Department of Education, 1980.

Giachino, Joseph W., and William Weeks, Welding Skills and Practices. Chicago, IL: American Technical Society, 1976.

Griffin, Ivan H., Edward M. Roden, and Charles W. Briggs, Basic Arc Welding. Albany, NY: Delmar.

Griffin, Ivan H., Edward M. Roden, and Charles W. Briggs, Basic Oxyacetylene Welding. Albany, NY: Delmar

Griffin, Ivan H., Edward M. Roden, and Charles W. Briggs, Basic TIG and MIG Welding. Albany, NY: Delmar

Griffin, Ivan H., Edward M. Roden, and Charles W. Briggs, Welding Processes. Albany, NY: Delmar, 1976.

Oregon, Welding, Individualized Learning Systems. Portland, OR: DCE Publications, 1975.

Sacks, Raymond J., Welding: Principles and Practices. Peoria, IL: Charles A. Bennett Co., Inc., 1976.

Schell, Frank R., and Bill Matlock, Industrial Welding Procedures. Albany, NY: Delmar, 1979.

V-TECS*, A Catalog of Performance Objectives, Criterion-Referenced Measures and Performance Guides for Combination Welder. Vocational-Technical Education Consortium of States, 1976.

*Available from Vocational Education Materials Center, University of Georgia (See Resource Addresses).

STUDENT MANUALS

Georgia*, Welding, Phase A, Oxyacetylene, Student Manual. Atlanta, GA: Georgia Department of Education, 1980.

Georgia*, Welding, Phase B, Shielded Metal Arc, Student Manual, Atlanta, GA: Georgia Department of Education, 1980.

Georgia*, Welding, Phase C, Tungsten Inert Gas, Student Manual. Atlanta, GA: Georgia Department of Education, 1980.

Georgia*, Welding, Phase D, Gas Metal Arc, Student Manual. Atlanta, GA: Georgia Department of Education, 1980.

AUDIO VISUALS

Georgia Department of Education*, "Welding" — Slide/Tapes

*Available from Vocational Education Materials Center, University of Georgia (See Resource Addresses).

ADDITIONAL INSTRUCTIONAL RESOURCES

ALUMINUM

The Aluminum Association, Inc.: Washington, D.C.,

a. Adhesive Bonding of Aluminum Automotive Body Sheet Alloys.

b. Aluminum Welder's Training Manual and Exercises. 1978.

c. Qualification Standard for Structural Welding of Aluminum. 1977.

d. Weldbonding - An Alternative Joining Method for Aluminum Auto Body Alloys. 1978, T17

American Welding Society, Welding Aluminum. Miami, FL, 1972.

Reynolds Metals Co., Joining Processes for Aluminum. Atlanta, GA.

EQUIPMENT

Hobart Brothers Co.: Troy, OH.

a. Hobart Arc Welding Systems.

b. Hobart Electrodes/Wire/Flux.

Lincoln Electric Co., Weld Directory of Electrodes for Mild and Alloy Steel. Cleveland, OH.

Miller Electric Mfg. Co.: Appleton, WI.

a. Arc Welding Equipment.

b. Arc Welding Equipment Selector Guide.

c. Welding Power Sources and Accessories.

d. Which Welding Power Supply Do You Need.

Union Carbide Corp.: Long Island City, NY.

a. Arc Gouging Equipment.

b. Cutting Machines and Carriages.

c. Heliarc Welding Equipment.

d. Industrial Gases and Distribution Equipment.

e. MIG Welding Equipment.

f. Oxweld and Sellstrom Safety Equipment.

g. Oxweld Harper and Tweco Welding Supplies.

h. Oxweld/Purox - Gas Welding, Heating and Cutting Equipment.

i. Plasma Arc Welding and Cutting Equipment.

j. Power Supplies.

k. Prest-O-Lite - Air-Acetylene, Air-Propane and Oxy-Acetylene Equipment.

l. Submerged Arc Welding Equipment.

m. Welding Wires and Rods.

GAS METAL ARC WELDING

The Aluminum Association, Inc.: Washington, D.C.
a. MIG Spot Welding. T11.

b. Repair of Aluminum Automotive Sheet by TIG and MIG Welding. T15.

c. Teacher's Guide to MIG and TIG Welding Aluminum.

Miller Electric Mgs. Co., The Gas Tungsten - Arc Welding Process. Appleton, WI.

Reynolds Metals Co.: Atlanta, GA.
a. MIG Welding Aluminum.

b. MIG Welding - The Effect of Arc Variations on Aluminum Welds.

c. Union Carbide Corp., MIG Welding Handbook. Long Island City, NY.

OXYACETYLENE

The Aluminum Association, Inc., Aluminum Soldering Handbook. Washington, D.C.

Chemetron Corp., Brazing and Soldering Manual. Atlanta, GA.

Reynolds Metals Co.: Atlanta, GA.
a. Different Not Difficult - Welding, Soldering Aluminum and Brazing.

b. Welding, Brazing and Soldering - Q & A.

Smith Welding Equipment: Minneapolis, MN.
a. Oxy-Acetylene Brazing, Cutting and Welding, Instructor's Manual

b. A Short Course for Gas Cutting, Welding, Brazing.

Union Carbide Corp.: Long Island City, NY.
a. Aluminum Brazing Handbook.

b. Basic Oxy-Acetylene Welding, Cutting and Heating Practices.

c. The Oxy-Acetylene Handbook.

SHIELDED ARC

Hobart Brothers Co., Modern Arc Welding: Procedure and Practice. Troy, OH.

Miller Electric Mfg. Co., Shielded Metal Arc Pipe Welding. Appleton, WI.

MISCELLANEOUS

American Welding Society, Publications Catalog. Miami, FL., 1979.

Hobart Brothers Co.: Troy, OH.
a. Blueprint Reading for Welders and Fitters, 1978.

b. Hobart School of Welding Technology Bulletin, 1978.

c. The Most Effective, Efficient, and Economical System to Teach/Learn Welding: Programmed A/V Training.

d. Recommendations for Teaching Welding: Setting Up Training Programs and Shops, 1971.

The Lincoln Electric Co.: Cleveland, OH.
a. Designer's Guide for Welded Construction, 1972.

b. Planning Aids for Arc Welding Instruction, 1971.

Miller Electric Mfg. Co., Welding and the World of Metals. Appleton, WI.

Monticello Books, The Welding Encyclopedia. Lake Zurich, IL.

Phillips, Arthur L., Current Welding Processes. Miami, FL: American Welding Society, 1968.

Phillips, Arthur L., Current Welding Processes, Instructor's Manual. Miami, FL: American Welding Society, 1968.

Reynolds Metal Co., Literature, Movie and Product Index. Atlanta, GA.

Smith Welding Equipment, Safety Posters and Instructor. Minneapolis, MN.

RESOURCE ADDRESSES

The Aluminum Association, Inc.
818 Connecticut Ave., N.W.
Washington, DC 20006

American Technical Society
5608 Stony Island Ave.
Chicago, IL 60637

American Welding Society
2501 N.W. 7th St.
Miami, FL 33125

Charles A Bennett Co., Inc.
809 West Detweiller Drive
Peoria, IL 61614

Chemetron Corporation
Arc Products Division
3515 Zip Industrial Blvd., S.E.
Atlanta, GA 30315

DCE Publications
P.O. Box 1491
Portland, OR 97207

Delmar Publishers
P.O. Box 5087
Albany, NY 12205
(800) 325-6000

The Goodheart-Willcox Co., Inc.
123 Taft Drive
South Holland, IL 60473

Hobart Brothers Company
Box DM-553
Troy, OH 45373

Reader's Service Department
Iron Age
One Decker Square
Bala-Cynwd, PA 19004

The Lincoln Electric Co.
Cleveland, OH 44117

Miller Electric Mfg. Co.
P.O. Box 1079
Appleton, WI 54912

Monticello Books
Lake Zurich, IL 60047

Reynolds Metals Company
Richmond, VA 23261
Sales Office in Georgia
62 Perimeter Center East
Atlanta, GA 30346

Smith Welding Equipment
Division of Tescom
Corporation
2600 Niagra Lane North
Minneapolis, MS 55441

Union Carbide Corporation
Linde Welding Reference
Library
47-36 36th St.
Long Island City, NY 11101

Victor Equipment Company
Manufacturing Plant
Airport Road
Denton, TX 76201

Vocational Education
Materials Center
University of Georgia
Green Street
Athens, GA 30602
(404) 542-4592

DO NOT FILM THIS PAGE

SECTION VII

STUDENT RECORDS

STUDENT RECORDS

This section contains four forms, the Individual Progress Report Chart, the Group Progress Chart, the Competency Checklist and the Certificate of Competency. The use of these Charts is described below and on page 6.

INDIVIDUAL PROGRESS REPORT

One copy should be kept in each student's confidential file and updated as tasks are completed. Grades should be assigned upon task completion and then averaged for grade reporting. Difficulty, excessive amounts of time, etc. should be noted on this form and should be discussed with the student.

GROUP PROGRESS CHART

This chart reflects task completion only and can be displayed in the classroom or lab area. Due to confidentiality of records, a grade must not be recorded. The instructor should maintain a copy of this record and update it daily.

INDIVIDUAL PROGRESS REPORT

NAME _____

PROGRAM/ CLUSTER _____ AREA _____

TASK/ UNIT NO.	UNIT TITLE	DATE STARTED	DATE COMP.	EST. TIME	GRADE

GROUP PROGRESS CHART

NAME	UNITS/TASKS																						

VII-5

COMPETENCY CHECKLIST

The Competency Checklist is an easy device for the instructor to use to know when a student is eligible to receive a Certificate of Competency (shown on page 9). One Checklist is used per student for as long as the student stays in the program. The instructor may use the checklist in the following manner:

1. Enter the student's name on the form.
2. As the student masters each task, check-off the task under each job title on the Competency Checklist for which it appears.
3. Keep the Checklist in each student's personal file or keep all Competency Checklists together in a separate file.
4. When all the tasks underneath a job title have been checked-off, the student is eligible to receive a Certificate of Competency for that job title.

CERTIFICATE OF COMPETENCY

The Certificate of Competency is issued by the instructor to certify that the student has mastered the tasks necessary for entry level employment for the job listed on the Certificate. The specific tasks that have been mastered are printed on the back of the Certificate, which can be used by the student to show a prospective employer exactly what the student is qualified to do. The Certificates should be printed ahead of time so that the instructor may simply fill in the front of the Certificate whenever a student is eligible to receive one, as indicated by the student's Competency Checklist. A sample completed Certificate of Competency appears on page 9 followed by a Certificate of Competency for each of the possible Welding program exit points (job titles).

The Certificate should be completed by the instructor as follows:

1. Enter the student's name.
2. Enter the school name.
3. Date and sign the Certificate.
4. It is recommended that the Certificate be stamped with the school seal.

COMPETENCY CHECKLIST

_____

Student Name

As the student masters each unit of instruction, check off the unit number under each of the following job titles where it appears. When all the units under a job title have been completed, the student is eligible to receive a Certificate of Competency for that job title.

REQUIRED FOR ALL JOB TITLES

( ) WLD-1
( ) WLD-2
( ) WLD-3
( ) WLD-4
( ) WLD-5
( ) WLD-6
( ) WLD-7

Welder Helper 819.687-014

( ) WLD-1 thru 7
( ) OXA-1
( ) OXA-2
( ) OXA-3
( ) OXA-4
( ) OXA-5
( ) OXA-12
( ) ARC-1
( ) TIG-1
( ) TIG-2
( ) TIG-3
( ) TIG-4
( ) TIG-10
( ) MIG-1
( ) MIG-2*
( ) MIG-6*
( ) MIG-7*
( ) MIG-8*

* Part

Brazer 813.684-010

( ) WLD-1 thru 7
( ) OXA-1
( ) OXA-2
( ) OXA-3
( ) OXA-4
( ) OXA-5
( ) OXA-6
( ) OXA-7
( ) OXA-16
( ) OXA-17
( ) OXA-18
( ) OXA-19

Oxyacetylene Welder 811.684-014

( ) WLD-1 thru 7
( ) OXA-1
( ) OXA-2
( ) OXA-3
( ) OXA-4
( ) OXA-5
( ) OXA-6
( ) OXA-7
( ) OXA-8
( ) OXA-9
( ) OXA-10
( ) OXA-11
( ) OXA-12
( ) OXA-13
( ) OXA-14
( ) OXA-15
( ) OXA-16
( ) OXA-17
( ) OXA-18
( ) OXA-19
( ) OXA-20
( ) OXA-21

Shielded Metal Arc Welder
810.384-014

( ) WLD-1 thru 7
( ) ARC-1
( ) ARC-2
( ) ARC-3
( ) ARC-4
( ) ARC-5
( ) ARC-6
( ) ARC-7

TIG Welder
810.384-014

( ) WLD-1 thru 7
( ) TIG-1
( ) TIG-2
( ) TIG-3
( ) TIG-4
( ) TIG-5
( ) TIG-6
( ) TIG-7
( ) TIG-8
( ) TIG-9
( ) TIG-10
( ) TIG-11
( ) TIG-12
( ) TIG-13
( ) TIG-14
( ) TIG-15
( ) TIG-16

MIG Welder
810.384-014

( ) WLD-1 thru 7
( ) MIG-1
( ) MIG-2
( ) MIG-3
( ) MIG-4
( ) MIG-5
( ) MIG-6
( ) MIG-7
( ) MIG-8

Combination Welder
819.384-010

( ) WLD-1 thru 7
( ) OXA-1
( ) OXA-2
( ) OXA-3
( ) OXA-4
( ) OXA-5
( ) OXA-6
( ) OXA-7
( ) OXA-8
( ) OXA-9
( ) OXA-10
( ) OXA-11
( ) OXA-12
( ) OXA-13
( ) OXA-14
( ) OXA-15
( ) OXA-16
( ) OXA-17
( ) OXA-18
( ) OXA-19
( ) OXA-20
( ) OXA-21
( ) ARC-1
( ) ARC-2
( ) ARC-3
( ) ARC-4
( ) ARC-5
( ) ARC-6
( ) ARC-7
( ) TIG-1
( ) TIG-2
( ) TIG-3
( ) TIG-4
( ) TIG-5
( ) TIG-6
( ) TIG-7
( ) TIG-8
( ) TIG-9
( ) TIG-10
( ) TIG-11
( ) TIG-12
( ) TIG-13
( ) TIG-14
( ) TIG-15
( ) TIG-16
( ) MIG-1
( ) MIG-2
( ) MIG-3
( ) MIG-4
( ) MIG-5
( ) MIG-6
( ) MIG-7
( ) MIG-8

CERTIFICATE OF COMPETENCY

This is to Certify that

Gerri DeWald

of

SAMPLE

Athens Area Vo-Tech School

has successfully mastered the competencies required to perform the job of OXYACETYLENE WELDER.

Charles C. Connor

June 15, 1981

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Oxyacetylene Welder.

OXYACETYLENE WELDER
· 811.684-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING

Following safety procedures and regulations for oxyacetylene welding
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch
Carrying a puddle without a filler rod
Welding and outside corner joint without a filler rod
Making beads with filler rods using oxyacetylene equipment
Welding butt joints
Welding lap joints
Welding T-joints
Setting up the oxyacetylene apparatus for flame cutting
Cutting with an oxyacetylene torch
Piercing and cutting holes using the oxyacetylene cutting torch
Cutting with an automatic oxyacetylene cutting machine
Welding beads with brass rods
Brazing a lap joint
Brazing with silver
Soldering
Welding cast iron using oxyacetylene apparatus
Cutting and welding pipe

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of WELDER HELPER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Welder Helper.

Welder Helper
819.687-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING

Following safety procedures and regulations for oxyacetylene welding
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch
Setting up the oxyacetylene apparatus for flame cutting

SHIELDED ARC WELDING

Selecting and setting up shielded arc welding apparatus

TUNGSTEN INERT GAS WELDING

Orientation to tungsten inert gas arc welding
Following safety procedures and regulations for TIG welding
Identifying TIG welding equipment
Setting up TIG equipment to weld aluminum
Setting up TIG equipment to weld stainless steel and mild steel

METAL INERT GAS WELDING

MIG orientation and safety
Setting up MIG equipment to weld mild steel plate
Setting up MIG equipment to weld stainless steel
Setting up MIG equipment to weld aluminum
Setting up MIG equipment for flux-cored arc welding (FCAW)

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of BRAZER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Brazer.

BRAZER
813.684-010

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading Blueprints

OXYACETYLENE BRAZING AND SOLDERING

Following safety procedures and regulations for oxyacetylene welding
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch
Carrying a puddle without a filler rod
Welding an outside corner joint without a filler rod
Welding beads with brass rods using oxyacetylene welding equipment
Brazing a lap joint using oxyacetylene apparatus
Brazing with silver using oxyacetylene equipment
Soldering

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of OXYACETYLENE WELDER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Oxyacetylene Welder.

OXYACETYLENE WELDER
811.684-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING

Following safety procedures and regulations for oxyacetylene welding
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch
Carrying a puddle without a filler rod
Welding and outside corner joint without a filler rod
Making beads with filler rods using oxyacetylene equipment
Welding butt joints
Welding lap joints
Welding T-joints
Setting up the oxyacetylene apparatus for flame cutting
Cutting with an oxyacetylene torch
Piercing and cutting holes using the oxyacetylene cutting torch
Cutting with an automatic oxyacetylene cutting machine
Welding beads with brass rods
Brazing a lap joint
Brazing with silver
Soldering
Welding cast iron using oxyacetylene apparatus
Cutting and welding pipe

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of SHIELDED METAL ARC WELDER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Shielded Metal Arc Welder.

SHIELDED METAL ARC WELDER
810.384-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

SHIELDED ARC WELDING

Selecting and setting up shielded arc welding apparatus
Welding string and weave beads
Welding string beads and padding a plate
Welding lap joints
Welding butt joints
Welding T-fillet joints
Testing joints

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of TUNGSTEN INERT GAS WELDER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Tungsten Inert Gas Welder.

TUNGSTEN INERT GAS WELDER
810.384-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

TUNGSTEN INERT GAS WELDING

Following safety procedures and regulations for TIG welding
Identifying TIG welding equipment
Setting up TIG equipment to weld aluminum
TIG welding stringer beads on aluminum plate
TIG welding lap joints using aluminum plate
TIG welding butt joints using aluminum plate
TIG welding fillet joints using aluminum plate
TIG welding corner joints using aluminum plate
Setting up TIG equipment to weld stainless steel and mild steel
TIG welding stringer beads on stainless steel and mild steel
TIG welding lap joints using stainless steel and mild steel
TIG welding butt joints using stainless steel and mild steel
TIG welding fillet joints using stainless steel and mild steel
TIG welding corner joints using stainless steel and mild steel
TIG welding pipe joints

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of _____ METAL INERT GAS WELDER _____.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Metal Inert Gas Welder

METAL INERT GAS WELDER
810.384-014

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading blueprints

METAL INERT GAS WELDING

MIG orientation and safety
MIG welding beads on mild steel plate
MIG welding butt joints using mild steel plate
MIG welding lap joints using mild steel plate
MIG welding fillet joints using mild steel plate
MIG welding with stainless steel
MIG welding with aluminum
Flux-cored arc welding (FCAW)

CERTIFICATE OF COMPETENCY

This is to Certify that

_____

of

_____

has successfully mastered the competencies required to perform the job of COMBINATION WELDER.

_____

_____

The student named on this certificate has demonstrated mastery of the following tasks required to perform the job of Combination Welder.

COMBINATION WELDER
819.384-010

FOUNDATIONS

Identifying and using welding symbols
Using welding related shop tools and equipment
Identifying and preparing metals for welding
Measuring welding materials
Using clamps and jigs
Reading Blueprints

OXYACETYLENE WELDING, CUTTING, BRAZING AND SOLDERING

Following safety procedures and regulations
Using oxyacetylene cylinders and gases
Inspecting oxygen and acetylene regulators
Selecting and maintaining oxyacetylene torches and tips
Setting up and lighting the oxyacetylene torch
Carrying a puddle without a filler rod
Welding an outside corner joint without a filler rod
Making beads with filler rods
Welding butt joints using filler rods
Welding lap joints using filler rods
Welding T-joints using filler rods
Setting up the oxyacetylene apparatus for flame cutting
Cutting with an oxyacetylene cutting torch
Piercing and cutting holes using the cutting torch
Cutting with an automatic oxyacetylene cutting machine
Welding beads with brass rods
Brazing a lap joint
Brazing with silver
Soldering
Welding cast iron
Cutting and welding pipe

SHIELDED ARC WELDING

Selecting and setting up shielded arc welding apparatus
Arc welding string and weave beads
Welding string beads and padding a plate
Arc welding lap joints
Arc welding butt joints
Arc welding T-fillet joints
Testing welded joints

TUNGSTEN INERT GAS WELDING

Following safety procedures and regulations for TIG welding
Identifying TIG welding equipment
Setting up TIG equipment to weld aluminum
TIG welding stringer beads on aluminum plate
TIG welding lap joints using aluminum plate
TIG welding butt joints using aluminum plate
TIG welding fillet joints using aluminum plate
TIG welding corner joints using aluminum plate
Setting up TIG equipment to weld stainless steel and mild steel
TIG welding stringer beads on stainless steel and mild steel
TIG welding lap joints using stainless steel and mild steel plate
TIG welding butt joints using stainless steel and mild steel plate
TIG welding fillet joints using stainless steel and mild steel plate
TIG welding corner joints using stainless steel and mild steel plate
TIG welding pipe joints

METAL INERT GAS WELDING

MIG orientation and safety
MIG welding beads on mild steel plate
MIG welding butt joints using mild steel plate
MIG welding lap joints using mild steel plate
MIG welding fillet joints using mild steel plate
MIG welding with stainless steel
Mig welding with aluminum
Flux-cored arc welding (FCAW)

SECTION VIII

SPECIAL NEEDS STUDENT

WORKING WITH SPECIAL NEEDS STUDENTS

Introduction

Special needs students are those who are designated as handicapped and/or disadvantaged. The 1976 vocational education amendment defines handicapped individuals as:

> Persons who are mentally retarded, hard of hearing, deaf, speech impaired, visually handicapped, seriously emotionally disturbed, orthopedically impaired, health impaired, or persons with other specific disabilities, who by reason thereof require special education and related services and who cannot succeed in the regular vocational education programs.

In Title II of the 1976 education amendments disadvantaged persons are defined as:

> Persons (other than handicapped persons) who have academic or economic disadvantages and who require special services, assistance or programs in order to enable them to succeed in vocational education programs.

Federal legislation requires that these special people be given an opportunity to function in a regular classroom. This section provides information on how special needs students are identified and how they can be mainstreamed into regular educational environments.

Figure One presents a model depicting various activities of the process in identifying and mainstreaming special needs students. These activities are conducted at three levels: the system level, the school level and the classroom level. All three levels must work together if implementation of the process is to be effective.

Identification Of The Special Needs Student

Through a variety of pre-testing procedures, special needs students are identified and their potentials are evaluated at the

SPECIAL NEEDS MAINSTREAMING MODEL

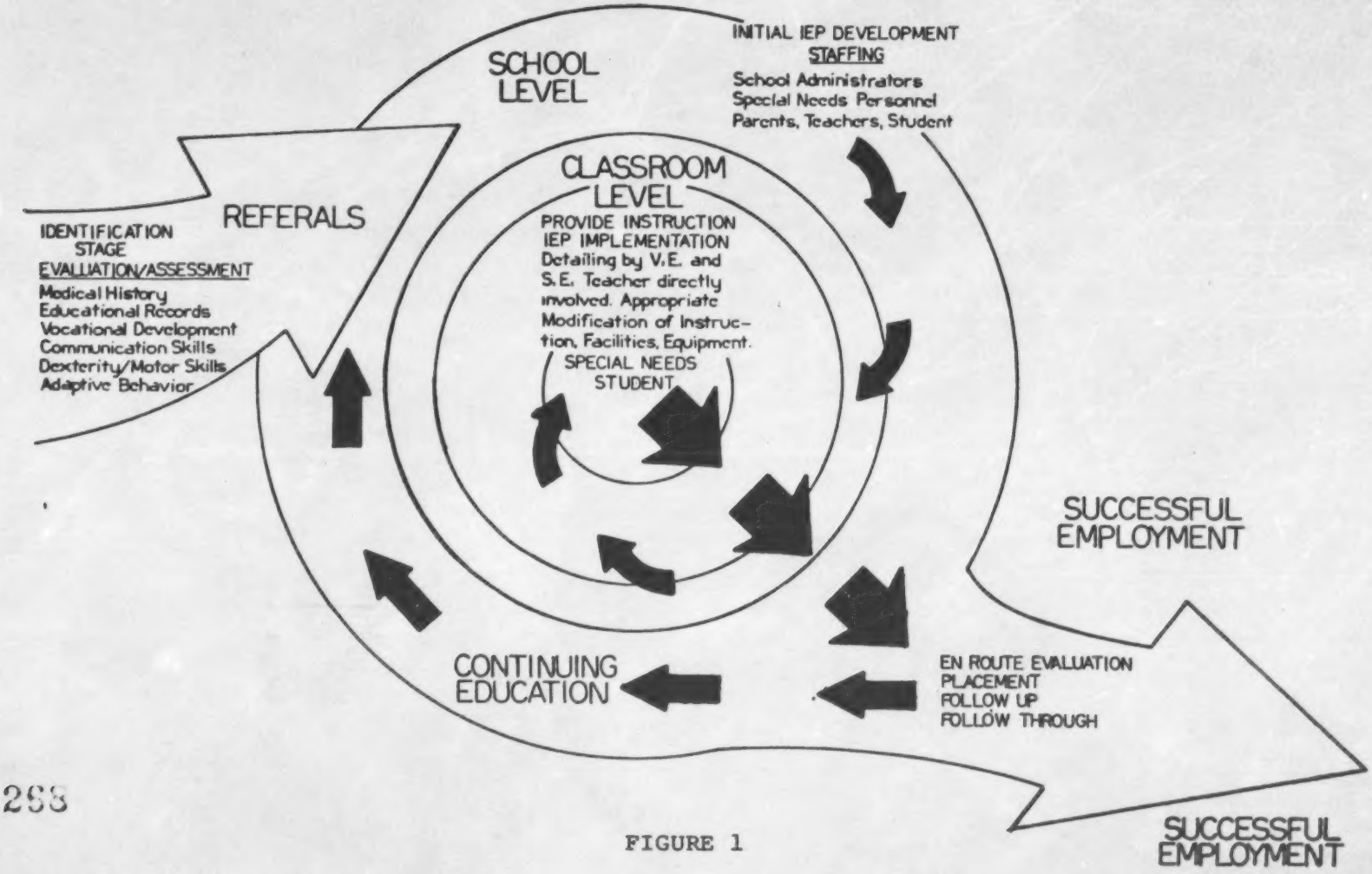


FIGURE 1

system level. This evaluation process consists of collecting and assessing the following data for each student:

-Medical History
-Educational Records
-Vocational Development
-Communication Skills
-Dexterity/Motor Skills
-Adaptive Behavior

When this procedure has been completed, the system personnel refers the student to the appropriate school level personnel.

Development of the Plan

At the school level, an Individual Education Plan (IEP) is developed for each special needs student. An IEP is a written plan which describes the educational objectives, both long and short term, and the support services for a special needs student. The plan is developed by the school administration, special education personnel, teacher(s) directly involved with the student and the parent(s). In some cases, the student may help with the development.

Implementing the I.E.P.

The actual implementing of the I.E.P. begins at the classroom level. The purpose of the teacher dealing with the special needs student is to help the student set realistic goals, identify the barriers which make it difficult for the student to learn and adapt the curriculum and/or facilities with reference to the I.E.P. so the student can learn while overcoming personal barriers.

Special needs students have problems which hinder their learning. Therefore, a teacher's job becomes more complicated than when teaching "regular" students. Handicapped students may have a variety of problems - mental, physical and/or emotional.

Academically disadvantaged students may exhibit language deficiencies, reading and writing deficiencies, computational deficiencies and general educational deficiencies. Economically disadvantaged students may possess an inability to concentrate because their primary needs - food, shelter, clothing - are not adequately met due to lack of money.

By considering these problems, teachers can modify existing programs to accommodate the needs of special needs learners. Some suggestions which may prove beneficial in modifying an existing curriculum are listed below:

-Prepare instructional materials in greater detail and assign work in shorter units.

-Provide more frequent evaluation of student's progress and provide opportunities for remedial work.

-Be aware of the student's limited vocabulary.

-Be aware of the student's inability to understand abstractions and generalizations and prepare materials accordingly.

-Keep the student aware of his or her progress and make the student feel he or she can succeed.

-Use real teaching aids, live work and practical experiences whenever possible.

-Choose reading material which is at the student's level, interest and experience.

-Use constructive criticism only.

-Use peer instruction whenever possible.

-Allow the student to advance at his or her own pace.

-Use the part-to-whole learning concept in adapting materials.

Materials Which Can Be Used to Teach Disadvantaged

In Georgia an effective set of materials has been developed to be used with a program to help disadvantaged students adjust

to life and work situations. This program is called CVAE or Coordinated Vocational Academic Education. The CVAE program is organized with a coordinator who is responsible for the type of instruction the students receive, and a team of teachers assigned to the coordinator who work cooperatively to help the disadvantaged students learn to enjoy school and become more successful students. CVAE materials include visuals in the form of synchronized slide/tape presentations. These units are designed to help the disadvantaged student become more successful in school, learn good work habits, become an aware consumer, and develop a better self-image and appearance. (Although designed especially for disadvantaged students, CVAE may also be used in regular classroom situations). The vocational education teacher should work with the CVAE coordinator to design a program of study for the disadvantaged students in areas in which the student needs help.

In some cases, facilities, must be modified for handicapped special needs students. In general, as long as the classroom/shop meets federal guidelines for barrier free design, extensive facility changes need not be made. For visually impaired students, for example, let the student locate in the classroom where he or she can see best even to the point of moving the desk or work station as a portable unit. In the case of orthopedically handicapped, some changes may have to be made to shop machinery to allow the student to use it. This may involve more convenient controls or special seating where the student would normally stand. In making these changes, special education expertise would be helpful.

Evaluation

Evaluation of the student's program should consist of:

-En-route evaluation (formative) to monitor the student's progress through the program.

-Summative evaluation upon completion of the program to determine job readiness.

-Follow-up after placement to determine if the student is successful on the job.

-Follow-through activities designed to identify any further training needed, which is indicated by the follow-up procedure.

Working with special needs students is much more demanding of the system, the school and the classroom teacher. However, with their patience and understanding, special needs students can not only succeed, but in many cases excell.

RESOURCES

To aid the teacher in modifying materials for special needs categories, the following references are listed by category. These are suggested references only as a world of materials exist on this subject.

Mentally Retarded

A Curriculum Guide for Teachers of Educable Mentally Retarded. Danville, Ill.: The Interstate Printers and Publishing Co., Inc.

High, Elizabeth C., and Moyers, Kathy L. Training Manual: Developing Pre-Vocational/Vocational Skills in Developmentally Disabled Persons. Washington, D.C.. Job Development Laboratory, George Washington University, 1976.

Kolstoe, Oliver P. Teaching Educable Mentally Retarded Children. Holt, Rinehart and Winston, 1976.

Mulligan, Robert E.; Gavin, Donald and Conaley, James. Comprehensive Career Education Curriculum Guide for the Trainable. New Brunswick, N.J.: Rutgers Vocational-Technical Curriculum Laboratory, 1977.

Introduction to Vocations for Educable Mentally Retarded. New Jersey: New Jersey Department of Education.

State of Ohio Curriculum Guide for Moderately Retarded Learners. Columbus, Ohio: Ohio Department of Education, 1977.

Tucker, Mark M. Learning through Curriculum Modification; A Blueprint to Teaching the Mentally Retarded. Johnstown, PA.: Mafex Associates, Inc., 1976.

Watson, Marjorie. Mainstreaming the Educable Mentally Retarded. Washington, D.C., NEA, 1975.

Hearing Impaired

Alvin, Howard P. The Evolution of an Evaluation Design for Evaluating Secondary Programs for the Deaf in Vocational Occupational-Technical Education (VOTE) Programs. ERIC - ED 123-241.

Guidelines: Educational Planning for the Hearing Handicapped. North Carolina Public Schools. Division for Exceptional Children, North Carolina Department of Public Instruction, Raleigh, N.C., 1977.

Munson, Harold L.; Eglston, Judy Cobb and Phillips, Gordon B. Career Education for Deaf Students: An Inservice Leader's Guide. University of Rochester, College of Education, Center for the Study of Helping Services, Rochester, N.Y. 1975.

Nix, Gary W. Mainstreaming Education for Hearing Impaired Children and Youth. Grune and Stratton, 1976.

Orthopedically and Other Health

A Model Plan for a Cooperative Vocational Rehabilitation Program. Office of Human Development, Rehabilitation Services and Administration. Department of Health, Education and Welfare, Washington, D.C.

Mallix, Kalisanker and Mueller, Jim. Vocational Aids and Enhanced Productivity of the Severely Disabled. The George Washington University Rehabilitation Research and Training Center, Washington, D.C. 1975.

McCarthy, Henry and Smart, Landon. Recommendations for Enhancing Employment Prospects of Handicapped Individuals. Comps. Human Resources Center, Albertson, L. I., 1978.

Duncan, John, et al. Environmental Modifications for the Visually Impaired: A Handbook. Visual Impairment and Blindness, December 1977, p. 442-455.

Disadvantaged

Guidelines for Methods and Techniques of Teaching Disadvantaged Students. Division of Vocational Education, Virginia Polytechnic Institute and State University, Blackburg, VA.

A Handbook for Developing Programs and Services for Disadvantaged Students. Department of Vocational Education Studies, College of Education, Southern Illinois, University of Carbondale, Carbondale, Ill. 62901

By Program

Adaption of Home Economics Curricula for Special Needs. North Dakota Research Coordination Unit, State Board for Vocational Education, State Office Building, Bismarck, ND.

Auto Body: An Adaptive and Developmental Program for Special Needs Students. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

Floriculture Board of Cooperative Educational Services of Nassaw County, Division of Occupational Education, Division of Special Education, Westburg, NY 1975.

Grubb, Francine. Basic Business - A Teacher's Guide to an Employment Orientation Course for Special Needs Students. Vocational Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

Home Economics and the Exceptional Student: A Handbook for Home Economics Teachers Working with Mentally Retarded Students. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1976.

Troutman, Carol M. Introduction to Office Occupations. Vocational-Technical Curriculum Laboratory, Rutgers - The State University, New Brunswick, N.J. 1974.

Working with the Handicapped in the Vocational Home Economics Classroom. Division of Vocational Education, State of Ohio, Columbus, Ohio.

Coordinated Vocational Education and Training (C.V.E.T.) manuals for disadvantaged, available from: Oklahoma State Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1515 West Sixth Avenue, Stillwater, Oklahoma 74074.

-CVET Construction 3100219 Teacher's Guide
3100209 Student

-CVET General Mechanics 3100239 Teacher's Guide
3100229 Student

General Special Needs

A Handbook for Modifying Vocational Curricula for Handicapped Students. Wisconsin Vocational Studies Center, University of Wisconsin, Madison, May 1980.

Bottoms, J.E. and Scott, C.P. Supportive services for special student groups. In J.E. Wall (ed.), Vocational Education for Special Groups. Sixth Yearbook, Washington, D.C.: American Vocational Association, 1976.

Gill, Douglas H. and Scott, C. Paul. A practical model for mainstreaming handicapped learners in vocational education. The Journal for Vocational Special Needs Education, Vol. 1, No. 3, April, 1979, pp. 3-7.

Gugerty, J., et al. Tools, Equipment and Machinery Adapted for the Vocational Educator and Employment of the Handicapped. Project #498749006, Wisconsin Vocational Studies Center, Madison, Wisconsin, January 1981.

Hull, Marc E., Berry, Owen J. and Clark, Donald L. Procedures for Teaching Vocational Concepts to Students with Special Needs. Texas A & M University, Final Report Project 62350274, June 1976.

The Related Vocational Instruction Program. Georgia's Approach to Vocational Education for the Handicapped at the Secondary level, Douglas H. Gill, Project Coordinator, Vocational Programs for the Handicapped, Georgia Southern College, Statesboro, Georgia.

Vocational Educational Resource Materials, A Bibliography of Materials for Handicapped and Special Education. Third edition, 1978. Wisconsin Vocational Studies Center, University of Wisconsin - Madison.

SECTION IX

FACILITY LAYOUT

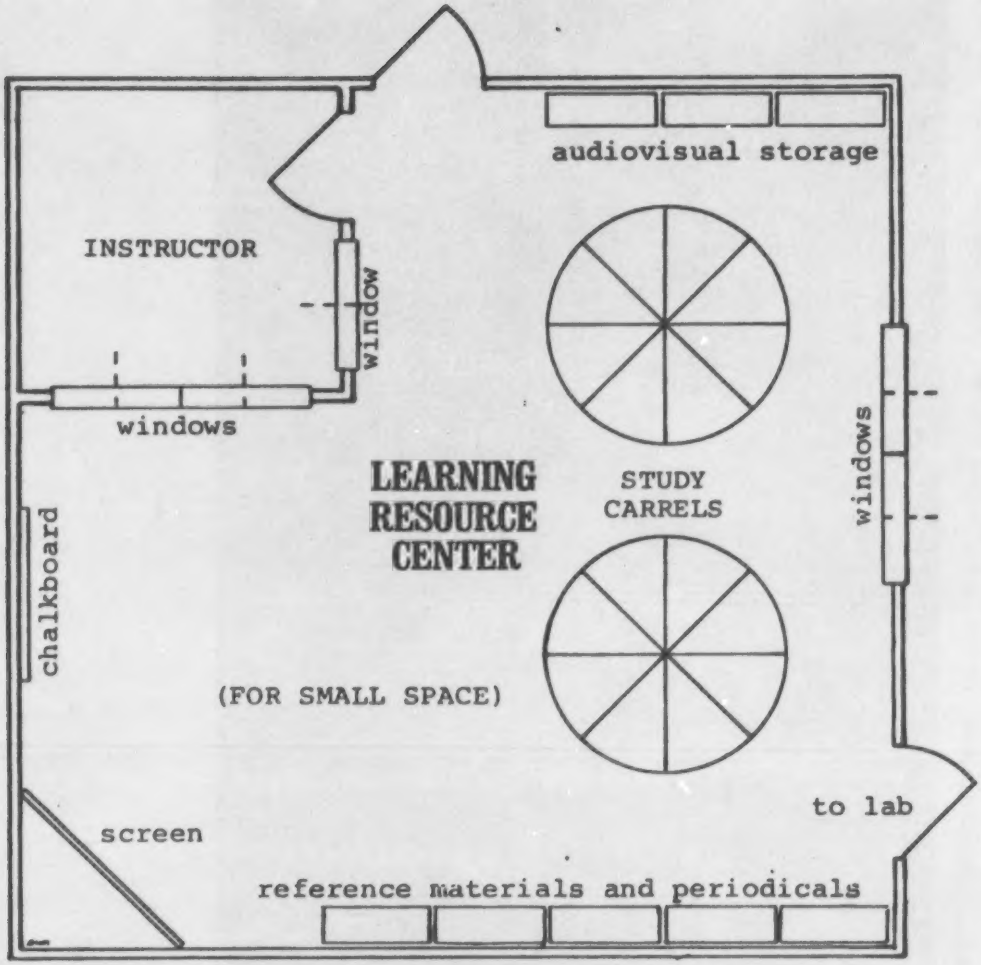
DO NOT REM THIS PAGE

Facility Layout

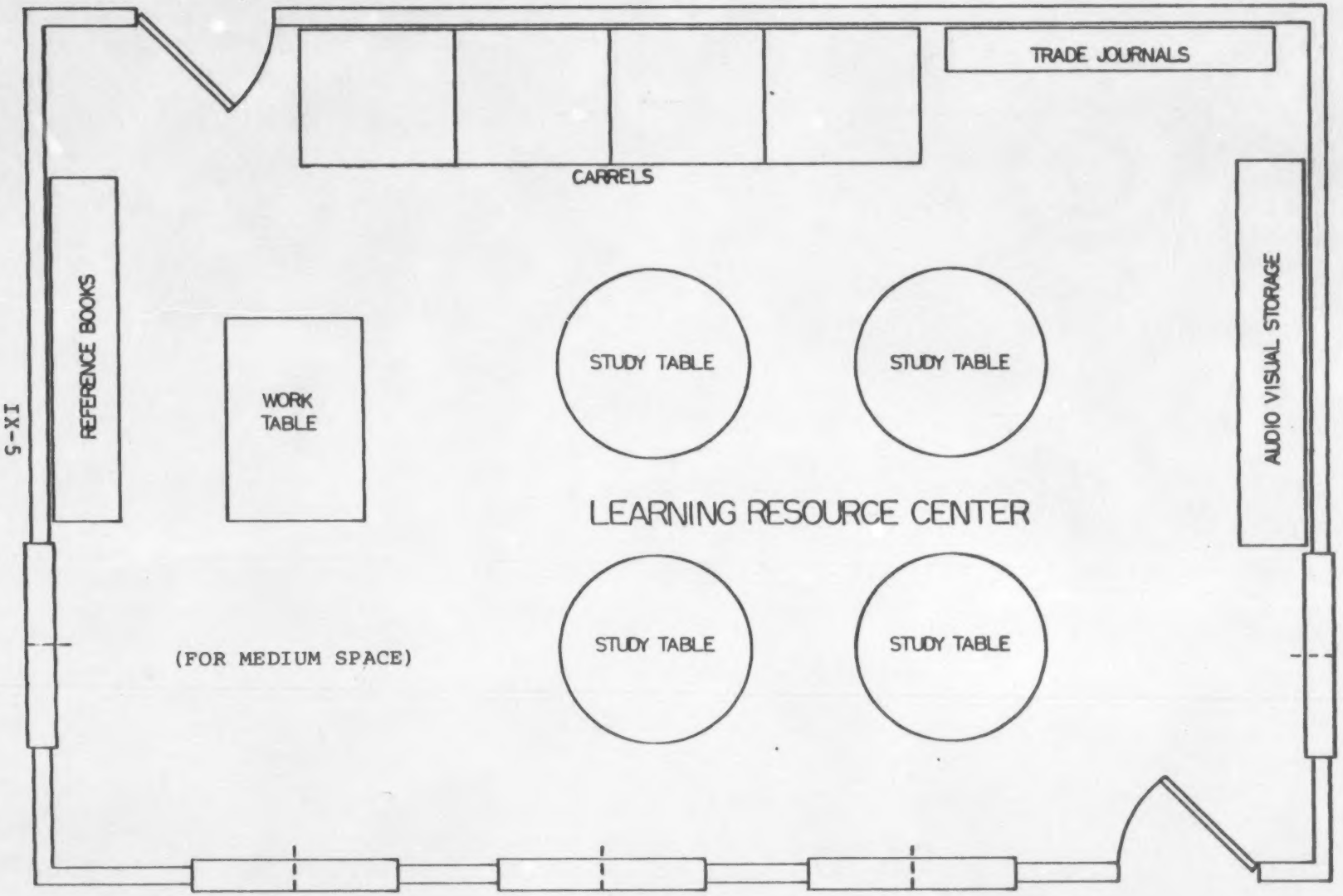
The facility layouts on the following pages are presented to aid in arranging the classroom and laboratory for efficient instruction. The three resource center arrangements represent small, medium and large centers. The instructor must determine an arrangement that best fits the needs of the students and the instructional method being used.

The laboratory facility layout is one recommended by the teachers who helped develop the Welding program materials. This facility is easily adaptable to a variety of arrangements that will best fit local needs.

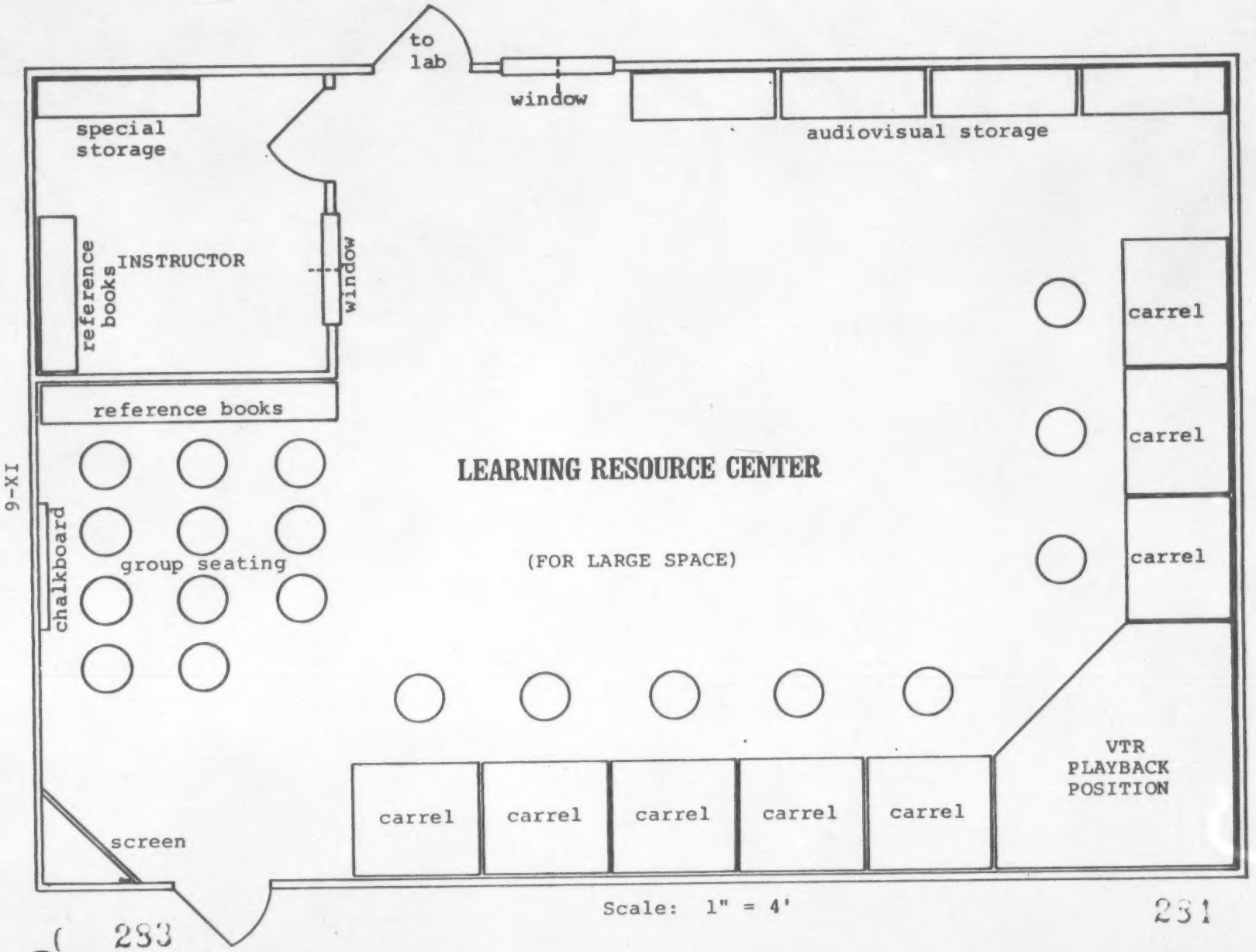
These layouts may be especially useful in those schools where classroom renovation or construction is being planned.


audiovisual storage
INSTRUCTOR
window
windows
LEARNING
RESOURCE
CENTER
STUDY
CARRELS
windows
chalkboard
(FOR SMALL SPACE)
to lab
screen
reference materials and periodicals

Scale: 1" = 4'

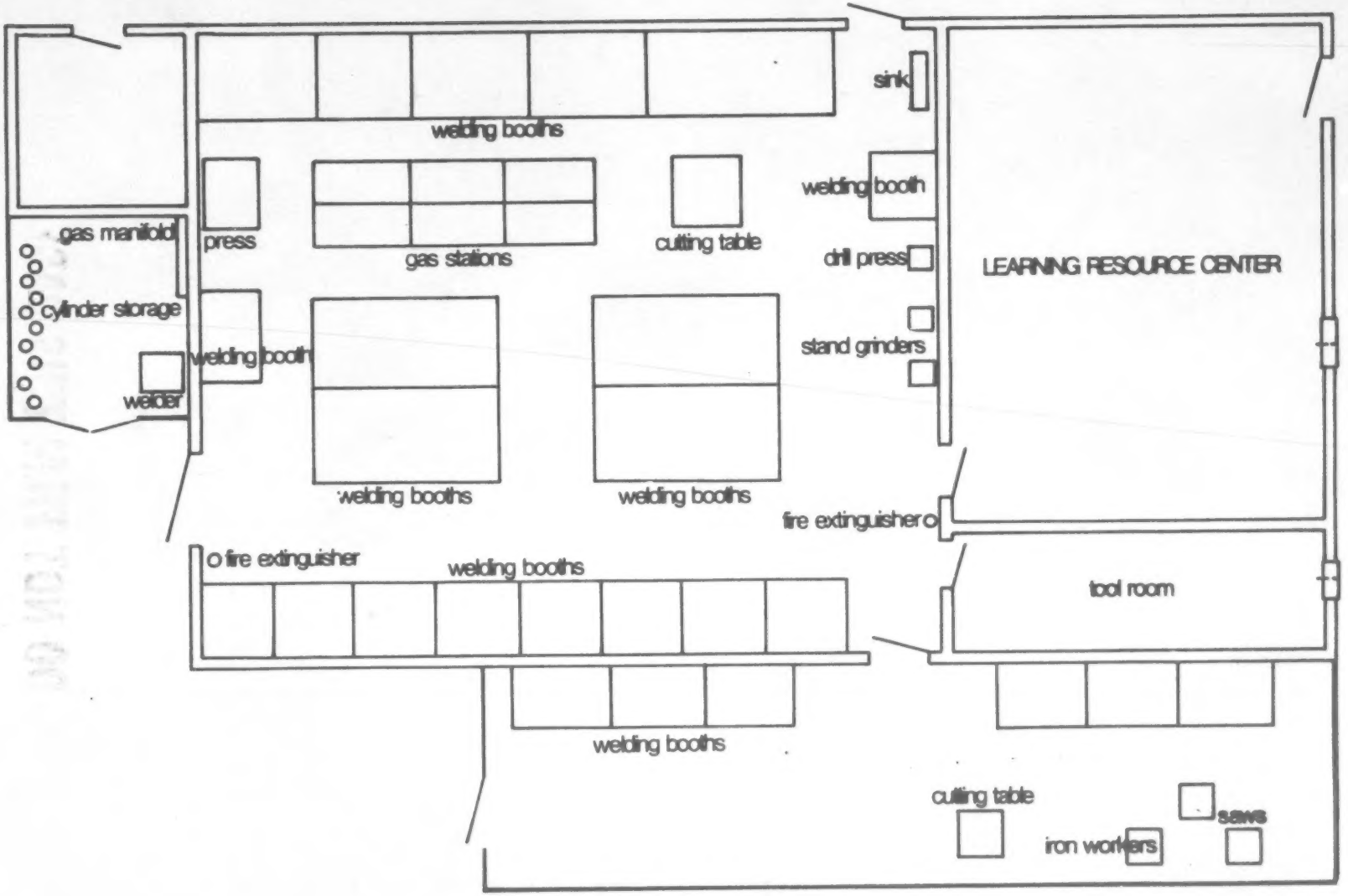

TRADE JOURNALS
CARRELS
REFERENCE BOOKS
WORK TABLE
STUDY TABLE
STUDY TABLE
AUDIO VISUAL STORAGE
LEARNING RESOURCE CENTER
STUDY TABLE
STUDY TABLE
(FOR MEDIUM SPACE)

S-XI


to lab
window
special storage
audiovisual storage
reference books
INSTRUCTOR
window
carrel
carrel
carrel
reference books
LEARNING RESOURCE CENTER
(FOR LARGE SPACE)
chalkboard
group seating
carrel
carrel
carrel
carrel
carrel
VTR PLAYBACK POSITION
screen
Scale: 1" = 4'

9-XI

WELDING LABORATORY LAYOUT



IX-7

SECTION X

DEFINITION OF TERMS

DEFINITION OF TERMS

1. AV's-Audiovisuals - May refer to any picture and/or sound media. (ie. slides, tapes, filmstrips, 16 mm films, etc.)

2. Checkpoint - A student-instructor interface point wherein the instructor may give the student a test, perform a demonstration, or simply provide the student with additional needed information or instructions. Also a checkpoint may be used for motivational purposes.

3. Competency - The ability (knowledge, skills and attitudes) to perform all of a group or cluster of related tasks required to complete a designated activity according to occupational standards. In the educational setting the statement of a competency includes expected student outcomes in terms of knowledge, skills, and attitudes required to complete a designated activity as defined by incumbent workers according to the standards of the work place.

4. Course - A grouping of tasks and competencies which have a common knowledge base or are within a given domain.

5. Criterion-Referenced Measure - An exercise based upon a performance objective, the accomplishment of which measures attainment of that objective.

6. Criterion-Referenced Test - A test designed to measure student competencies based on job or industrial standards.

7. Curriculum Guide - A document containing the objectives, content, organization, and structure of an instructional program. It is designed for use by administrators, instructional supervisors and teachers.

8. D.O.T. - Abbreviation for Dictionary of Occupational Titles. Document provides nine digit codes identifying each occupation.

9. Duty - One of the distinct major activities involved in the work performed, comprising related tasks.

10. Exit Point - A predetermined point within an instructional program in which a student may exit with the essential competencies for a specific job. Usually defined in terms of D.O.T. codes and/or O.E. codes.

11. "Hands-On" - Statement implying the student is physically involved in a learning activity.

12. Individualized Instruction (I.I.) - A system of instruction allowing for a student to progress at their fastest rate.

13. Job - A specific area of specialization within an occupational field consisting of several closely related duties for which a person would expect to receive remuneration. Should be identified by DOT code.

14. Job Sheet - (Or Operations Sheet) - A project of a performance nature. Generally performed by the student in a lab or shop type environment or in a specialized work area.

15. Live Work - Generally refers to items brought into the course area for repair or adjustment. Examples of live work might be automobiles, radios and TV's, air-conditioners, etc. Another form of live work would be patrons visiting the cosmetology department to receive permanents or other services.

16. Master Copies - Original copies of slides, tapes or written materials set aside for the purpose of duplication.

17. Occupational Cluster - A group of occupations sharing a common core of competencies. Georgia's comprehensive high school vocational program is organized around this concept.

18. Occupational Inventory - A listing of tasks to be performed in a particular occupational area, grouped under duty classifications.

19. O.E. - Refers to the U. S. Office of Education. O.E. codes are a classification system (taxonomy) for occupational education programs.

20. Open Entry - Term meaning that a student may enter the program at any time and does not have to wait for quarter or semester breaks.

21. Open Exit - Term meaning that a student may leave a program any time he/she completes their occupational objective.

22. Performance Guide - A series of steps, arranged in a sequence ordinarily followed, which when completed may result in the performance of a task. Also called "teaching steps."

23. Performance Objective - A statement in precise, measurable terms of a particular behavior to be exhibited by a learner under specified conditions. It possesses each of the elements or characteristics specified below:

    a. Condition - The testing situation confronting the learner is clearly specified. This includes equipment provided or withheld, environmental constraints such as temperature, space, etc.

b. Performance - The specific behavior expected of the learner is stated.

c. Standard - The degree of acceptable performance is specified.

24. Performance Test - A test entailing not only the ability to answer questions, but measuring the students' ability to operate, manipulate, or perform a given task as well.

25. Program - An organized sequence of courses leading to an occupational objective. A program may contain one or more student exit points as defined by D.O.T. codes.

26. Program Objective - The outcome of a prescribed program of instruction. Usually expressed in terms of the occupation or job for which training is designed. D.O.T. codes are frequently used to identify program objectives or student exit points.

27. Self-Paced - Refers to a student moving through the prescribed training program at the fastest pace at which the student can meaningfully learn.

28. Sequencing - Putting any set or series of learning activities or tasks into proper order or sequence. Normally arranged from the simple to complex within groupings or blocks.

29. Software - Written or printed materials, slides, filmstrips, tapes, etc.

30. Student Manual - A document designed for use by students in a specific instructional program. It contains unit sheets, references, operational procedures or job sheets, etc.

31. Task - The smallest division of work in which a measurable output occurs. A logical and necessary step in the performance of a duty.

32. Task List - A listing of tasks performed by incumbent workers within a domain of interest. An example is a listing of all tasks performed by an automotive mechanic or by a worker in ornamental horticulture.

33. Unit - One "module" training materials; generally covering one learning task and programmed on one Unit Sheet. May cover more than one lesson.

34. Unit Guide - A curriculum guide sheet that lists a task and objective with the instructional activities, instructional materials, evaluation and approximate time required for a student to successfully complete the task.

35. V-TECS Catalog - A comprehensive collection of performance objectives, performance guides, criterion-referenced measures, and related data, organized by a job structure or career ladder within a domain of interest.

Federal law prohibits discrimination on the basis of race, color or national origin (Title VI of the Civil Rights Act of 1964); sex (Title IX of the Educational Amendments of 1972 and Title II of the Vocational Education Amendments of 1976); or handicap (Section 504 of the Rehabilitation Act of 1973) in educational programs or activities receiving federal financial assistance.

Employees, students and the general public are hereby notified that the Georgia Department of Education does not discriminate in any educational programs or activities or in employment policies.

The following individuals have been designated as the employees responsible for coordinating the department's effort to implement this nondiscriminatory policy.

Title II - Loydia Webber, Vocational Equity Coordinator
Title VI - Peyton Williams Jr., Associate Superintendent of State Schools and Special Services
Title IX - Evelyn Rowe and Myra Tolbert, Coordinators
Section 504 - Jane Lee, Coordinator of Special Education

Inquiries concerning the application of Title II, Title VI, Title IX or Section 504 to the policies and practices of the department may be addressed to the persons listed above at the Georgia Department of Education, State Office Building, Atlanta 30334; to the Regional Office for Civil Rights, Atlanta 30323; or to the Director, Office for Civil Rights, Education Department, Washington, D.C. 20201.